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Project No. 4980

SOURCE EVALUATION REPORT

Clearwater Paper Corporation
Lewiston, Idaho

M&D No. 1 and No. 2 Sawdust Digesters
Internal Process Points

Pre-Test Feasibility Study

Test Dates: December 2 through 5, 2013

Test Site:
Clearwater Paper Corporation
803 Mill Road
Lewiston, Idaho 83501

Report ID: HORIZON ENGINEERING 13-4980

Air Pollution Emission Testing

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1. QUALITY STATEMENT

I certify that this testing was performed in accordance with Horizon Engineering's Quality Assurance Manual (QAM). At the date of this testing, Horizon Engineering was in conformance with ASTM D7036-04 "Standard Practice for Competence of Air Emission Testing Bodies." As of August 20, 2012 Horizon Engineering received interim accreditation status from the Stack Testing Accreditation Council (STAC). A copy of the interim accreditation letter from STAC is included in the Appendix of this report.

David Bagwell, QSTI
Technical Manager

Signature David Bagwell   Date 1/20/2014

Name, Telephone Number and E-mail address of AETB
Horizon Engineering
503-255-5050
dbagwell@horizonengineering.com

Name and E-mail Address of the Qualification Exam Provider
Source Evaluation Society (SES)
qstiprogram@gmail.com

2. CERTIFICATION

2.1 Test Team Leader

I hereby certify that the test detailed in this report, to the best of my knowledge, was accomplished in conformance with applicable rules and good practices. The results submitted herein are accurate and true to the best of my knowledge.

Name: Joseph Heffernan III, QSTI

Signature ____________ Date 1/20/14

2.2 Report Review

I hereby certify that I have reviewed this report and find it to be true and accurate, and in conformance with applicable rules and good practices, to the best of my knowledge.

Name: David Bagwell, QSTI

Signature ____________ Date 1/20/14

2.3 Report Review

I hereby certify that I have reviewed this report and find it to be true and accurate, and in conformance with applicable rules and good practices, to the best of my knowledge.

Name: Michael E. Wallace, PE

Signature ____________ Date 1/28/14

3. INTRODUCTION

3.1 Study Site: Clearwater Paper Corporation
803 Mill Road
Lewiston, Idaho 83501

3.2 Mailing Address: Same as above

3.3 Feasibility Study Purpose and Overall Goals: The pre-test feasibility study purpose was to determine if future testing can be done for Compliance with the EPA Request for Information, July 19, 2013 and extension granted on August 28, 2013.

A source test plan to meet the RFI was prepared and sent to EPA on October 17, 2013. Zach Hedgpath's response included a request to discuss the possibility of steam saturation in the exhaust gas. On November 6, 2013 Bob Pernsteiner of Clearwater Paper Corp. checked three of the eight sample ports and discovered problems with the ports to be used for TRS and methanol sampling. Steam was present in the ports and the ports clogged from the cooking liquor and sawdust in the gas stream within 10 to 20 minutes after being cleared.

In addition there were safety concerns because of the steam and hazardous liquid and gas in the exhaust. These became issues when the port was located at the bottom of the duct and material poured out when the port was opened for sampling. They were a special safety concern for the ports that were under pressure. Finally there were concerns about the possibility of needing to shut processes down for testing constraints. David Bagwell passed this information to Roylene Cunningham and Zach Hedgpeth of EPA Region 10. Because of the challenges to the testing effort, Mr. Hedgpeth recommended a pre-test feasibility evaluation. The test was to evaluate each of the eight proposed sample points, to review concerns identified by Horizon, and determine mitigations.

During the field study, Horizon planned to observe the sampling locations to determine if there was dry gas at the sample locations and if the presence of sawdust or other contaminants in the ports affected sampling. The safety concerns were to be addressed before the study was to begin. Horizon planned to conduct preliminary sampling and flow testing at each of the four locations on at least one of the M&D systems.

3.4 Specific Goals: After examining the sample ports to determine if it was safe to work in the area, the testers would attempt to obtain samples from the ports, modifying the methods as necessary. The minimum plan included collecting the following information:

- Dry bulb temperatures
- Wet bulb temperatures
- Static pressures
- Ability to collect Summa canisters in a conventional or non-conventional way for ASTM D5504-08 analysis
- Ability to collect EPA Method 308 samples in a conventional or non-conventional way
- Ability to do EPA flow rates and what modifications may be necessary for future measurements.

Observations, photographs, and testing modifications were recorded, and a summary is provided in Section 6.1.2 Sampling Notes. Copies of all field notes are in the Appendix. Any necessary testing method modifications used to collect the sample and flows and the results were documented.

3.5 Test Log:

M&D No. 1 and No. 2 Digesters: methanol, flow, exhaust moisture

Test Date	Test Time	Sample Points	Test
Dec. 3, 2013	13:55 – 15:01	1a-4a & 1b-4b	Moisture (psychrometry)
Dec. 4, 2013	09:18 – 11:18	1a	Methanol
Dec. 5, 2013	10:25 – 11:15	1b, 2b, 1a, 2a	Flow (two replicates)

Summary: Safety, process, and test concerns were addressed and documented and data were collected for the eight sampling locations for M&D No. 1 and No. 2. Testing that could be completed and results calculated are listed in the test log. All other observations are recorded in the body of the report.

3.6 Participants:

Horizon Personnel:

Joseph Heffernan, QSTI/QI, Team Leader, Calculations, and Report Review

Kyle Kline, QSTI; Thomas Lyons, QSTI; Jason Sweeney; Field Technicians

Michael E. Wallace, PE, Calculations and QA/QC

David Bagwell, QSTI, Report Review

Kate Krisor, Technical Writer

Test Arranged by: Rick Wilkinson, Marv Lewallen, and Bob Pernsteiner, Clearwater Paper Corporation

Observers:

Plant Personnel: Rick Wilknson and Bob Pernsteiner

Agency Personnel: Zach Hedgpeth, Environmental Engineer, EPA Region 10

Test Plan Sent to: Roylene Cunningham and. Zach Hedgpeth, P.E., EPA – Region 10

4. SUMMARY OF CONCLUSIONS AND RESULTS

Test Feasibility Horizon Engineering was able to address the safety, process, and test sampling concerns to obtain flow, moisture, and methanol results for some of the sampling locations. The actions necessary to complete the sampling are described below. Because sampling for methanol was possible on sample point 1a it is assumed that TRS sampling could also be possible at 1a.

Although sampling was completed on some ports, Horizon notes that the conditions were volatile enough that testing success would be very dependent on the process. The evidence for this is shown in the different stack temperatures for ports 1a and 1b—similar process points on the No. 1 and No. 2 Digester units, respectively. The temperature was 209°F for 1a and 217°F (steam) for 1b. Testing was feasible in 1a but it would not be feasible in 1b, in the steam saturated condition. Therefore we conclude that testing may not be feasible for 1a on a separate day dependent on process conditions.

Process points 2a and 2b were tested for moisture and flow, but not for methanol. Based on the temperatures at Points 2a and 2b (similar process points on No. 1 and No. 2 Digester, respectively), these locations show similar sampling feasibility as 1a and 1b. The temperature at 2a was 209°F, and at 2b it was 213°F (steam), indicating that testing could be feasible in 2a but not in 2b.

Process points 3a, 4a, 3b, 4b will not be used because these ducts were saturated with steam and debris. Also, during the feasibility study, Zach Hedgpeth of EPA informed the testers and Clearwater that EPA did not consider it necessary to test in locations 3 and 4.

Measures to Facilitate Testing Special ports with piping and valves to close off the duct when the ports were opened were installed on all of the process points by Clearwater personnel for testing. More descriptions of the ports are in Section 5.2.

With the special port pipes, normal PPE equipment and full face respirators as needed are sufficient to protect the testers. Special additional protective gear (full face respirator with special cartridge) is needed when the ducts are opened and cleared.

Testing Modifications A two-hour methanol sample was obtained from sampling Point 1a with the following modifications to the EPA Method 308 train. These modifications were primarily to adjust for the very high moisture concentration in the exhaust gas.

1. Standard size impingers were used instead of midget impingers
2. Impinger outlet temperature was not measured because of the availability of test equipment on site.
3. Fittings available to the testers on-site (stainless steel), were placed in the sample train, at the stack interface and impinger exit.
4. Two additional standard size impingers for moisture removal were added to the train.

Also, the testers determined that the sampling volume would be difficult to control to achieve the required minimum because of interference from moisture. Two empty impingers were used during the study, but it is recommended that three empty impingers be used. Clogging and possibly 100% steam made it impossible to test at the 3a process point.

Flows were measured across one traverse of the horizontal ducts (Process points 1a, 2a, 1b and 2b) through the special flow pipe ports. It was not possible to do two traverses 90° apart as specified in EPA Method 1A because of debris flow from the second port which was located at the bottom of each duct.

Results A summary of Horizon Engineering field notes is in Section 6.1.2. Joseph Heffernan and Thomas Lyons recorded their observations, testing notes, and recommendations during the study and complete copies of these are in the Appendix. Photographs for the testing are in Section 5.4 and in the Appendix.

Tables 1 and 2 present the flow and methanol results obtained during the feasibility study.

4.1 Tables of Results:

Table 1

Methanol, Flow & Moisture Test Results

M&D Digester No. 1 (Sample Points 1a, 2a, 3a, 4a)

Test Dates: Dec. 2-5, 2013	**Units**	**Point 1a**	**Point 2a**	**Point 3a**	**Point 4a**
EPA M-308 Date		Dec. 4, 2013			
EPA M-308 Start Time		09:18	--	--	--
EPA M-308 End Time		11:18	--	--	--
Sampling Time	minutes	120	--	--[1]	--
Sampling Results					
Methanol Concentration [2]	ppmv	135	--	--	--
Rate	lb/hr	0.0061	--	--	--
Production-Based	lb-MeOH/ODTP	0.00061			
Sample Volume	dscf	1.97	--	--	--
Sample Weight	µg	9987	--	--	--
Flow Rate (Actual) [3]	acf/min	349	737	--	--
Flow Rate (Standard)	dscf/min	9	67	--	--
Temperature, wet bulb	°F	209	208	213	209
Temperature, dry bulb	°F	209	209	213	209
Moisture [4]	%	95.8	88.3	103.7	95.8
Process/Production Data					
EPA M-308 Test Period					
Pulp Production Rate [5]	ODTP/day	240			
	ODTP/hr	10			

[1] It was not possible to sample methanol at Point 3a because of port clogging, excessive moisture (or steam) and the leaking sample train. See Section 6.1.2.
[2] Methanol was tested at Point 1a on December 4, 2013. Methanol attempted at Point 3a on December 5, 2013.
[3] Flow rates were measured on December 5, 2013.
[4] Moisture testing (wet bulb and dry bulb temperatures) was done on all sources on December 3, 2013.
[5] Production data was provided by Rick Wilkinson of Clearwater Paper Corporation.

Table 2

Flow & Moisture Test Results [6]

M&D Digester No. 2 (Sample Points 1b, 2b, 3b, 4b)

Test Dates: Dec. 2-5, 2013	**Units**	**Point 1b**	**Point 2b**	**Point 3b**	**Point 4b**
Sampling Results					
Flow Rate (Actual)	acf/min	939	906	--	--
Flow Rate (Standard)	dscf/min	17	-12	--	--
Temperature, wet bulb	°F	210	212	205	212
Temperature, dry bulb	°F	217	213	200	213
Moisture [7]	%	97.7	101.7	79.7	101.7

4.2 Discussion of Quality Assurance Procedures:

4.2.1 Manual Methods: QA procedures outlined in the test methods were followed when they were applicable. These include equipment operation, calibrations, sample recovery and handling, and calculations.

Pre- and post-test calibrations on the meter box is included with the report along with semi-annual calibrations of critical orifices, pitots, and thermocouples and indicators.

4.2.2 EPA Method 308 Laboratory QA: QA results are in the ALS Environmental laboratory report. Field blank, method blank, duplicate analysis, matrix spike and laboratory control samples were within acceptable limits.

[6] Methanol testing was not attempted on M&D No. 2. It is assumed that if it is possible at Point 1a on M&D No. 1 then it may be possible at Point 1b on M&D No. 2.

[7] Moisture testing (wet bulb and dry bulb temperatures) was done on all sources on December 3, 2013.

5. SOURCE DESCRIPTION AND OPERATION

5.1 Process and Control Device Description and Operation:

The sawdust pulping system includes two M&D continuous digesters, each operating at approximately 250 ADT/day of equivalent bleached pulp production. Two sawdust storage silos pneumatically feed sawdust to the top of a cyclone separator, where the wood and transport air are separated. On each line, the wood drops into a storage vessel known as the Kone bin, located below the cyclone. Each Kone bin typically contains 10 to 15 feet of wood during normal operation.

On each line, sawdust gravity feeds from the Kone bin into a metering screw, which feeds a rotary inlet valve known as the Bauer valve, before dropping into the digester itself. The rotary inlet valve contains 10 pockets. As the pockets rotate they are sealed against the casing of the valve. The seal prevents back-flow from the pressurized digester vessel.

Fresh steam is used in each rotary inlet valve to heat the sawdust, to pressurize the valve pockets, and to help push sawdust out of the valve pockets to purge the pocket. Sawdust then falls by gravity into the digester vessel. The majority of this steam is either discharged into the digester vessel with the sawdust, or is recycled from the discharge side of the valve to the inlet side of the valve via the primary exhaust line. Secondary exhaust from each rotary inlet valve flows to an exhaust chamber, where it is sprayed with a condensing shower of mill water. Any remaining material not condensed and injected into the sawdust through the metering screw will move through two lines into the bottom of the Kone bin. In addition to the secondary exhaust line, a line from the drop chute between the metering screw and the rotary inlet valve also flows to the exhaust chamber. (See Figure 1).

Once the wood enters the digester it falls onto a midfeather separating plate, where it is confined between constantly moving flights. The flights carry the sawdust down the top side of the midfeather, around the lower end of the digester, and then up the bottom half of the divided digester. When the sawdust reaches the top of the digester, it exits out of the discharge nozzle (on the bottom side of the digester) and falls into the surge tube, before going on to the blow tank. From the blow tank the sawdust pulp is washed and screened, prior to a final bleaching operation.

5.2 Test Ports: Port locations for the eight process sample points identified by EPA are listed below and described on the diagrams provided by Clearwater Paper.

- Sample Point 1a M&D No. 1: Exhaust to Kone Bin
- Sample Point 2a M&D No. 1: Exhaust to Kone Bin
- Sample Point 3a M&D No. 1: Secondary Exhaust from the Rotary Valve to the Exhaust Chamber
- Sample Point 4a M&D No. 1: Exhaust line from Drop Chute to Exhaust Chamber
- Sample Point 1b M&D No. 2: Exhaust to Kone Bin
- Sample Point 2b M&D No. 2: Exhaust to Kone Bin
- Sample Point 3b M&D No. 2: Secondary Exhaust from the Rotary Valve to the Exhaust Chamber
- Sample Point 4b M&D No. 2: Exhaust line from Drop Chute to Exhaust Chamber

Figure 1 - Process and Sample Point Diagram

Note: The above diagram reflects M&D No.1 installed sample points 1a, 2a, 3a, & 4a. Installed sample points 1b, 2b, 3b, & 4b for M&D No.2 are located in the same relative position.

Special ports with piping and valves to close off the duct when the ports were opened were installed on all of the process points by Clearwater personnel for testing. One smaller diameter pipe port was used for temperature, moisture and methanol sampling

Two larger diameter ports were located at 90° angles on the horizontal ducts for points 1a, 1b, 2a, and 2b for flow measurement. The two port pipes met EPA Method 1A criteria. One port was at the side of the duct and one at the bottom of the duct. The side ports were used for flow testing; the bottom ports could not be used because of material exiting the port. The testers used a wider diameter pipe adapter fitted to the outside of the flow port to allow use of the S-type pitot. A single adapter was moved to each sample point for flow measurements.

Orifice plates were installed on process Points 3 and 4 on both Digesters. As explained earlier these sample locations will not be used.

5.3 Operating Parameters: See Production/Process Data section of Appendix. The operating mode during the feasibility study was at normal operating rates and conditions. The pulp from these digesters is processed through a 4-stage brownstock washing line, and then through a 4-stage bleach plant. The pulp is used in the manufacture of bleached paperboard.

5.4 On-Site Photographs:

Figure 1

Sample Port 4a - Wet Bulb / Dry Bulb Temperature Measurement

Figure 2

Sample Port 1a – EPA Method 308 Methanol Sampling Setup

6. SAMPLING AND ANALYTICAL PROCEDURES

6.1 Sampling Procedures:

6.1.1 Sampling and Analytical Methods: Testing was in accordance with procedures and methods listed in the Pre-Test Feasibility Plan dated November 25, 2013 (see Correspondence Section in the Appendix), referencing the following: EPA methods in Title 40 Code of Federal Regulations Part 60 (40 CFR 60), Appendix A, July 1, 2011 and the Emission Measurement Technical Information Center's website, Test Methods Section (www.epa.gov/ttn/emc). The field pre-test evaluation is be conducted to determine the suitability of testing according to the following methods:

Sample Points 1a and 2a (M&D No.1) and 1b and 2b (M&D No.2):

Flow Rate:	EPA Methods 1A and Modified 2C (S- pitot flow traverses of duct <12")[8]
CO_2 and O_2:	Assume ambient molecular weight 28.96
Moisture:	Modified EPA Method ALT-008 (impinger catch incorporated with EPA Method 308) for Point 1a
Moisture:	ODEQ Method 4 (wet /dry bulb temperatures) and psychrometric equation; for all sample points
Methanol:	Modified EPA Method 308 (sorbent tube and impinger with analysis by GC/FID) [9]

Sample Points 3a and 4a (M&D No.1) and 3b and 4b (M&D No.2):

Flow Rate:	EPA Methods 1A and 2D (calibrated orifice plates)
CO_2 and O_2:	Assume ambient molecular weight 28.96
Moisture:	ODEQ Method 4 (wet /dry bulb temperatures) and psychrometric equation; for all sample points

[8] Modified to use a S-type pitot because it is expected that a p-type pitot may plug due to the presence of sawdust and the moisture content of the gas stream.
[9] The EPA Method 308 train was modified to use standard size impingers instead of midget impingers to capture moisture.

6.1.2 Sampling Notes:

Notes were recorded by Joseph Heffernan and Thomas Lyons during the study. A copy of all the notes is in the Appendix. In this section a summary of notes from each day is provided.

December 3, 2013 was the first full day of testing. Safety for the testers was the first issue addressed. Supplied air respirators had been ordered for the testers, but did not arrive on time. Clearwater Paper personnel donned their special protective equipment and cleared out the ports so that the testers were able to take wet bulb / dry bulb measurements at all of the sample points.

On December 4, 2013 the testers began attempts to conduct a two-hour EPA Method 308 test. With modifications to the sampling train (larger impingers, two empty ones behind the reagent-filled impinger, and stainless steel connectors for the train) a run was begun. Sample point 1a was used. Even with the extra empty impingers to catch moisture the high amount of moisture in the exhaust gas interfered with the testing. It was found to be very difficult to maintain the correct sampling rate. A two hour run was completed at 11:20.

On December 5, 2013, the last day of testing, the testers attempted to run an EPA Method 308 methanol sample train on Point 3a. The run was begun and after 60 minutes of sampling it was discovered that the sample train fittings were leaking and no sample had been collected, possibly because of clogging. After cleaning out the port, testing went on for another 10 minutes before the port was checked again. The sample train line was moved to the port that included an orifice plate and the train was started again. When the port was opened again to check for clogging, steam shot out of the port. The leaking train, possible clogging and steam concentration in the exhaust caused the testers to abandon the methanol test on this location. Later Zach Hedgepath informed the testers that it would not be necessary to test the ports at process locations 3 and 4.

Flows on all of the process points at locations 1 and 2 on both digesters were attempted next. After the first attempts the testers determined that flow could be measured from only one of the ports on each horizontal duct. The ports had been placed at 90° angles from each other, at the side and bottom of the duct. Liquid and sawdust poured from the first bottom port attempted. Therefore flow measurements on all locations were taken from one traverse across the duct, through the side ports. The testers kept close watch on the pitots, clearing lines as needed. Two sets of traverses were completed for sample locations 1a, 2a, 1b and 2b.

Moisture and flow rates were calculated for all measurements collected.

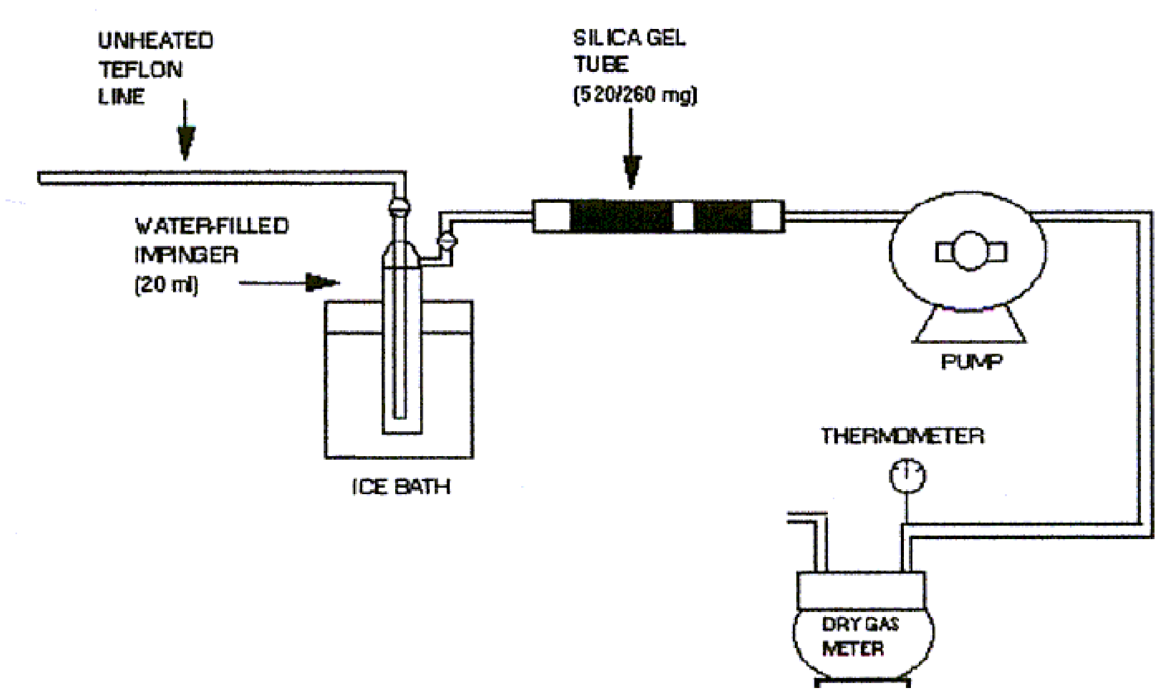
6.1.3 Laboratory Analysis:

Analyte	**Laboratory**
Methanol	ALS Environmental, Kelso, Washington

6.2 Sampling Train Diagram:

Figure 3

EPA Method 308 Methanol - Sample Train Diagram



6.2.1 Diagram Exceptions:

- Standard size impingers instead of midgets
- Impinger outlet temperature not measured
- Stainless steel fitting at stack interface and impinger outlet
- Two additional standard size impingers for moisture removal

6.3 Horizon Test Equipment:

6.3.1 Manual Methods:

Equipment Name	**Identification**
Non-Isokinetic Meter	CAE Express (Liter meter with internal pump), Horizon No. LMB 4
Pitot and Thermocouple	SR-48A
Shortridge® Micromanometer	SR-1
Barometer	Calibrated Barometer

7. CONCLUSION

During field evaluation, EPA and Horizon observed that testing locations 3 and 4 are infeasible for both M&D digester systems. Testing is also infeasible for locations 1 and 2, without significant modifications to test methods and atypical effort to reduce clogging and saturation prior to sampling. Even with these adjustments, testing results will be dependent upon process conditions and testers' ability to clear ports of steam saturation. Sampling conditions vary with process conditions and therefore testing feasibility cannot be guaranteed.

APPENDIX

Abbreviations & Acronyms

Abbreviations and Acronyms Used in the Report

AAC	Atmospheric Analysis & Consulting, Inc.
ACDP	Air Contaminant Discharge Permit
ADEC	Alaska Department of Environmental Conservation
ADL	Above Detection Limit
BAAQMD	Bay Area Air Quality Management District
BACT	Best Achievable Control Technology
BCAA	Benton Clean Air Agency
BDL	Below Detection Limit
BHP	Boiler Horsepower
BIF	Boiler and Industrial Furnace
BLS	Black Liquor Solids
C	Carbon
C_3H_8	Propane
CAS	Columbia Analytical Laboratory
CEM	Continuous Emissions Monitor
CEMS	Continuous Emissions Monitoring System
CERMS	Continuous Emissions Rate Monitoring System
CET	Calibration Error Test
CFR	Code of Federal Regulations
CGA	Cylinder Gas Audit
CH_2O	Formaldehyde
CH_4	Methane
Cl_2	Chlorine
ClO_2	Chlorine Dioxide
CNCG	Concentrated Non-Condensable Gas
CO	Catalytic Oxidizer
CO_2	Carbon Dioxide
COC	Chain of Custody
CTM	Conditional Test Method
CTO	Catalytic Thermal Oxidizer
Dioxins	Polychlorinated Dibenzo-p-dioxins (PCDD's)
DLL	Detection Level Limited
DNCG	Dilute Non-Condensable Gas
dscf	Dry Standard Cubic Feet
EIT	Engineer in Training
EPA	Environmental Protection Agency
ESP	Electrostatic Precipitator
EU	Emission Unit
FID	Flame Ionization Detector
Furans	Polychlorinated Dibenzofurans (PCDF's)
GC	Gas Chromatography
gr/dscf	Grains Per Dry Standard Cubic Feet
H_2S	Hydrogen Sulfide
HAP	Hazardous Air Pollutant
HCl	Hydrogen Chloride
HHV	Higher Heating Value
HRSG	Heat Recovery Steam Generator
IDEQ	Idaho Department of Environmental Quality
lb/hr	Pounds Per Hour
LHV	Lower Heating Value
LRAPA	Lane Regional Air Protection Agency
MACT	Maximum Achievable Control Technology
MDI	Methylene Diphyenyl Diisocyanate
MDL	Method Detection Limit
MEK	Methyl Ethyl Ketone
MeOH	Methanol
MMBtu	Million British Thermal Units
MRL	Method Reporting Limit
MS	Mass Spectrometry
MSF	Thousand Square Feet
NCASI	National Council for Air and Steam Improvement

Abbreviations and Acronyms Used in the Report

NCG	Non-condensable Gases
NCUAQMD	North Coast Unified Air Quality Management District
NDIR	Non-dispersive Infrared
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
NMC	Non-Methane Cutter
NMVOC	Non-Methane Volatile Organic Compounds
NWCAA	Northwest Clean Air Agency
NO_x	Nitrogen Oxides
NPD	Nitrogen Phosphorus Detector
O_2	Oxygen
ODEQ	Oregon Department of Environmental Quality
ORCAA	Olympic Region Clean Air Agency
PAHs	Polycyclic Aromatic Hydrocarbons
PCWP	Plywood and Composite Wood Products
PE	Professional Engineer
PM	Particulate Matter
ppbv	Parts Per Billion by Volume
ppmv	Parts Per Million by Volume
PS	Performance Specification
PSCAA	Puget Sound Clean Air Agency
PSEL	Plant Site Emission Limits
psi	pounds per square inch
PTE	Permanent Total Enclosure
PST	Performance Specification Test
PTM	Performance Test Method
QA/QC	Quality Assurance and Quality Control
QSTI	Qualified Source Testing Individual
RA	Relative Accuracy
RAA	Relative Accuracy Audit
RACT	Reasonably Available Control Technology
RATA	Relative Accuracy Test Audit
RCTO	Rotary Concentrator Thermal Oxidizer
RM	Reference Method
RTO	Regenerative Thermal Oxidizer
SCD	Sulfur Chemiluminescent Detector
SCR	Selective Catalytic Reduction System
SO_2	Sulfur Dioxide
SOG	Stripper Off-Gas
SRCAA	Spokane Regional Clean Air Agency
SWCAA	Southwest Clean Air Agency
TAP	Toxic Air Pollutant
TCA	Thermal Conductivity Analyzer
TCD	Thermal Conductivity Detector
TGNENMOC	Total Gaseous Non-Ethane Non-Methane Organic Compounds
TGNMOC	Total Gaseous Non-Methane Organic Compounds
TGOC	Total Gaseous Organic Compounds
THC	Total Hydrocarbon
TIC	Tentatively Identified Compound
TO	Thermal Oxidizer
TO	Toxic Organic (as in EPA Method TO-15)
TPH	Tons Per Hour
TRS	Total Reduced Sulfur
TTE	Temporary Total Enclosure
VE	Visible Emissions
VOC	Volatile Organic Compounds
WC	Inches Water Column
WDOE	Washington Department of Ecology

Nomenclature

NOMENCLATURE

Constants	Value	Units	Definition	Ref
Pstd(1)	29.92126	inHg	Standard Pressure	CRC
Pstd(2)	2116.22	lbf / ft²		CRC
Tstd	527.67	°R	Standard Temperature	CRC
R	1545.33	ft lbf / lbmol °R	Ideal Gas Constant	CRC
MW-atm	28.96456422	lbm / lbmole	Atmospheric (20.946 %O_2, 0.033% CO_2, Balance N_2+Ar)	
MW-C	12.011	lbm / lbmole	Carbon	CRC
MW-CO	28.0104	lbm / lbmole	Carbon Monoxide	CRC
MW-CO_2	44.0098	lbm / lbmole	Carbon Dioxide	CRC
MW-H_2O	18.01534	lbm / lbmole	Water	CRC
MW-NO_2	46.0055	lbm / lbmole	Nitrogen Dioxide	CRC
MW-O_2	31.9988	lbm / lbmole	Oxygen	CRC
MW-SO_2	64.0628	lbm / lbmole	Sulfur Dioxide	CRC
MW-N_2+Ar	28.15446807	lbm / lbmole (Balance with 98.82% N_2 & 1.18% Ar)	Emission balance	
C1	385.3211297	ft³ / lbmol	Ideal Gas Constant @ Standard Conditions	
C2	816.5455228	inHg in²/ °R ft²	Isokentics units correction constant	
Kp	5129.4	ft / min [(inHg lbm/mole) / (°R inH_2O)] ^½	Pitot tube constant	Ref 2.5.1

Symbol	Units	Definition	Calculating Equation or Source of Data	EPA
As	in²	Area, Stack		
An	in²	Area, Nozzle		
Bws	%	Moisture, % Stack gas	[100 Vw(std) / [Vw(std)+Vm(std)]]	Eq. 5-3
C	ppmv-C	Carbon (General Reporting Basis for Organics)		
C1	ft^3/lbmol	Gas Constant @ Standard Conditions	[R Tstd / Pstd(2)]	
C2	inHg in²/ °R ft²		[14,400 Pstd / Tstd]	
Cd	lbm-GAS / MMdscf	Mass of gas per unit volume	[Cgas MWgas / C1]	
cg	gr/dscf	Grain Loading, Actual	[15.432 mn / Vm(std) 1,000]	Eq. 5-6
cg @ X%CO_2	gr/dscf	Grain Loading Corrected to X% Carbon Dioxide	[X% / CO_2%]	
cg @ X%O_2	gr/dscf	Grain Loading Corrected to X% Oxygen	[(20.946-X) / (20.946-O_2)]	
Cgas	ppmv, %	Gas Concentration, (Corrected)		
Cgas @ X%CO_2	ppmv	Gas Concentration Correction to X% Carbon Dioxide	[X% / CO_2%]	
Cgas @ X%O_2	ppmv	Gas Concentration Correction to X% Oxygen	[(20.946-X%) / (20.946-O_2%)]	
Cgas	ppmv		Mgas (lbm/hr) * 1,000,000*385.3211/60*Qsd*mw	
CO	ppmv	Carbon Monoxide		
Co	ft	Outer Circumference of Circular Stack		
Ci	ft	Inner Circumference of Circular Stack		
CO_2	%	Carbon Dioxide		
Cp		Pitot tube coefficient		
Ct	lb/hr	Particulate Mass Emissions	[60 cg Qsd/ 7,000]	
dH	in H_2O	Pressure differential across orifice		
Dn	in	Diameter, Nozzle		
dp^½		Average square root of velocity pressure		
Ds	in	Diameter, Stack		
E	lb / MMBtu	Pollutant Emission Rate	Cgas Fd MWgas (20.946 / (20.946-O_2)) / (1,000,000 C1)	
Fd	dscf / MMBtu	F Factor for Various Fuels		Table 19-1
I	%	Percent Isokinetic	[C2 Ts(abs) Vm(std) / (vs Ps mfg An Ø)]	Eq. 5-8*
Md	lbm / lbmole	Molecular weight, Dry Stack Gas	[(1-%O_2-%CO_2)(MWn2+ar)+(%O_2 MW-O_2)+(%CO_2 MW-CO_2)]	Eq. 3-1*
mfg		Mole fraction of dry stack gas	[1-Bws/100]	
Mgas	lbm/hr	Gaseous Mass Emisisons	[60 Cgas(ppmv) MW Pstd(2) Qsd / 1,000,000 R Tstd]	
mn	mg	Particulate lab sample weight		
Ms	lbm / lbmole	Molecular weight, Wet Stack	[Md mfg +MW-H_2O (1-mfg)]	Eq. 2-5
MW	lbm / lbmole	Molecular Weight		
NO_2	ppmv-NO_2	Nitrogen Dioxide (General Reporting Basis for NOx)		
NOx	ppmv-NO_2	Nitrogen Oxides (Reported as NO_2)		
O_2	%	Oxygen		
OPC	%	Opacity		
Pbar	in Hg	Pressure, Barometric		
Pg	in H_2O	Pressure, Static Stack		
Po	in Hg	Pressure, Absolute across Orifice	[Pbar + dH / 13.5951]	
Ps	in Hg	Pressure, Absolute Stack	[Pbar + Pg / 13.5951]	Eq. 2-6*
Qa	acf/min	Volumetric Flowrate, Actual	[As vs / 144]	
Qsd	dscf/min	Volumetric Flowrate, Dry Standard	[Qa Tstd mfg Ps] / [Pstd(1) Ts(abs)]	Eq 2-10*
Rf	MMBtu/hr		1,000,000 Mgas (20.946-O_2)] / [Cd Fd 20.946]	
SO_2	ppmv-SO_2	Sulfur Dioxide		
t	in	Wall thickness of a stack or duct		
TGOC	ppmv-C	Total Gaseous Organic Concentration (Reported as C)		
Tm	°F	Temperature, Dry gas meter		
Tm(abs)	ºR	Temperature, Absolute Dry Meter	[Tm + 459.67]	
Ts	°F	Temperature, Stack gas		
Ts(abs)	ºR	Temperature, Absolute Stack gas	[Ts + 459.67]	
Vlc	ml	Volume of condensed water		
Vm	dcf	Volume, Gas sample		
Vm(std)	dscf	Volume, Dry standard gas sample	[Y Vm Tstd Po]/ [Pstd(1) Tm(abs)]	Eq. 5-1
vs	fpm	Velocity, Stack gas	Kp Cp dp^½ [Ts(abs) / (Ps Ms)]^ ½	Eq. 2-9*
Vw(std)	scf	Volume, Water Vapor	0.04707 Vlc	Eq. 5-2
Y		Dry gas meter calibration factor		Fig. 5.6
Ø	min	Time, Total sample		

* Based on equation.

Test Feasibility

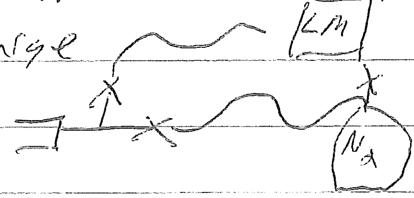
Field Notes During Sampling
Clearwater Paper Notes Nov. 6, 2013
Photographs

12/2/13 (Joseph Heffernan)

- wet bulb dry bulb ⇒ steam? how much.
- Flows at T6 method 2 locations
- Using a Magnehelic check to see if we can get pressure readings at orifice plates
-

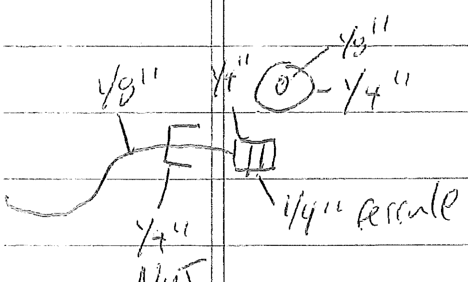
12/3/13

- safety is a huge concern
- talk extensively about potential options for testing. Three things I suggested doing: 1) dilution / Mass flow controller
 2) N_2 Purge



When sample starts to clog purge test close valve to Liter meter (LM) open valve to N_2 cylinder.

3) coupled with 1+2 or not Insert a 1/8" ~~[illegible]~~ TFE Line into port + flow will bend it so opening is not facing into flow.



\# - Method deviations
- standard impingers used instead of midgets
- No imp outlet temperature
- SS pieces on the train.

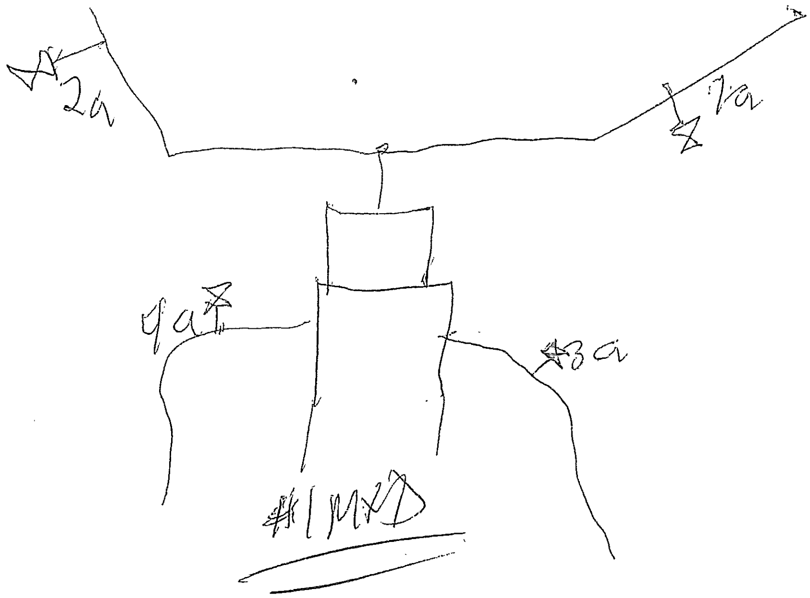
- 1a + 2a are 8"
- Horizontal port only for flows on 1a + 2a due to safety concerns.

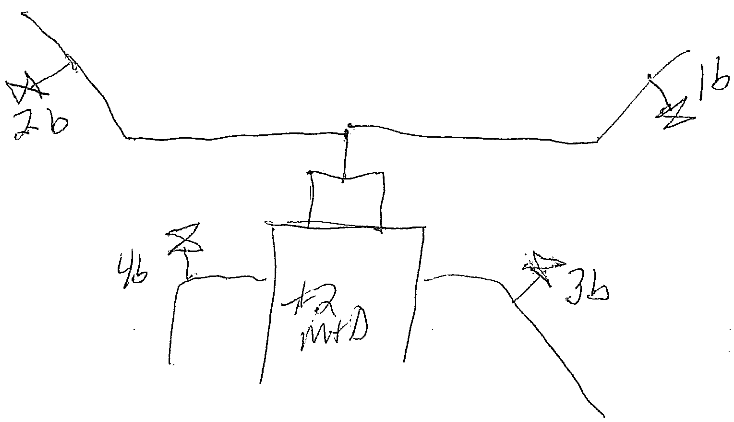
- if we need more than thirty days to summarize results we need to just let Zach know.

\# - Actual testing date on test plan being some kind of verbage saying we need to ~~[illegible]~~ wait for EPA's + Clearwaters response.

- PDF to Zach / Report of the Feasibility study.

- Sue Thing in the report needs to be said about the locations that exhibited steam like temperatures. 1A + 2A looks ok, 1b + 2b looks like steam.
- Zach / EPA seems to be ok with ~~note~~ testing @ 3 + 4 on both units due to our inability to pull a proper sample.
-


2a
7a
4a
3a
#1 MXD


2b
1b
4b
3b
#2 MXD

12/3/13 (Thomas Lyons)

Supplied air respirator that we were waiting on didn't get shipped, so at 13:15 a plant guy with a full face respirator came around to all the ports to rod them out and allow us to get temperatures. Using a wire-only thermocouple threaded through 1/4" teflon attached with a reducer to the ball-valve, able to effectively seal off the opening while opening the valve, threading the thermocouple down through it. Began taking wet bulb/dry bulb temps:

Wet bulb/dry bulb temps:

Point 3a:	Dry = ~~216~~ 213 Wet = 213	(photo #1)	taken at 13:35
Point 4a:	Dry = 209 Wet = 209	(photo #2,4)	taken at 13:45
Point 4b	Dry = 213 Wet = 212	(photo #5)	taken at 14:20
Point 3b	Dry = 200 Wet = 205	(photo #6)	taken at 14:35
Point 2b	Dry = 213 Wet = 212	(photo #7)	taken at 14:40
Point 1b	Dry = 217 Wet = 210	(photo #9)	taken at 14:45
2a	Dry = 205 Wet = 208	(photo #10)	taken at 14:53
1a	Dry = 209 Wet = 209	(photo #11)	taken at 15:01

- Full ~~[illegible]~~ size impingers + liter meter
- N_2 Back flush
- ~~[illegible]~~

12/4

Attempted a 2-hour sample run using method 308 with some deviations:

- Using 3 x full sized impingers instead of midgets. 1st with 100 mL of H_2O, 2nd and 3rd empty
- Necked down to teflon-tygon-M308 ampule-tygon-teflon from last impinger, so no impinger exit Tc for impinger exit temp.
- Had metal in sampling system, swage at stack interface and exit of last impinger.
- with amount of water collecting in the impingers (> 1500 mL in 2 hours) it was difficult to keep sampling rate consistent, ended up with ~55L sample at end. (<60L)

With deviations, run was successfully completed, after 120 minutes, water was bubbling into the 3rd impinger and the 1st and 2nd were completely full, should probably use a 4th impinger for future testing.

Run started at 09:20 at sample point 1A, as shown in photos #12 and 13

12/5

Running a second modified M308 2 hour run at point 3A. Started at 07:49. As shown in photo #14. This did not work. See below.

Took Wb/Db temps at point 3A (from orifice plate sample port) at 8:41
Dry = 214
Wet = 214.

Also took wb/db from sample point 1A at 08:49
wet = 209
Dry = 209

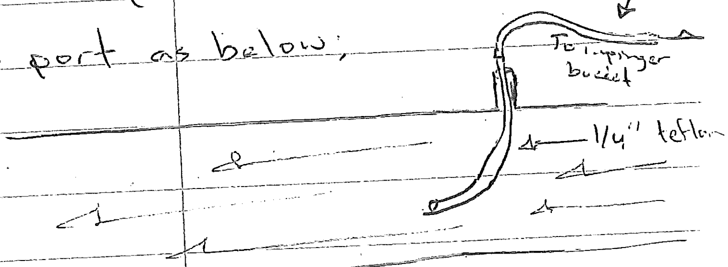
Started attempting flows on sample point 2b at 09:17 with port rodded out 10 minutes prior, when ball valve opened a solid stream of liquid poured out bottom port.* Will not be able to get flows across stack from side port because short (modified) S-type only just gets into duct from nipple, and long modified s-type hits I-beam and so unable to get it into swage on nipple.

*Photo #15 shows liquid stream, 09:28

M308 run scrapped. Sample port was clogging. After 60 minutes, noticed that not enough moisture was collecting in impingers, nut was removed ~~and~~ from port to check it out and it was completely clogged so there was a leak in the port fittings. Cleared the port of debri, reset the train and tightened down union to sample port and tried again, couldn't pull because of clogging of sample port after 10 minutes. Paused train.

This all being done on port seperate from orifice plate ports. for whatever reason, this port is clogging but orifice plate ports are remaining clear, so moved probe (teflon) to orifice plate port Started run there, clogging.

Tried again with a piece of teflon inserted down through the port as below;



Liter water box unable to pull, Removed 3/8" teflon thinking it was clogging, and steam was shooting out of the port; Not Clogging. ALOT of moisture was being collected in the train. Box would pull when disconnected from stack but not when connected, something to do with pressure effects from the stack in conjunction with the large amount of moisture?

10:25 Flow set, taken at point 1b, took set of 10 flows at ~ centroid of stack, blew out pitot (saw visible steam, and then liquid water coming out of holes) and then took another set of 10 flows again at the ~ centroid.

(Set 1)	(Set 2)
0.4964	0.3458
0.3571	0.4877
0.2947	0.3645
0.2083	0.3547
0.2662	0.2303
0.2802	0.4893
0.4108	0.3021
0.3367	0.3367
0.3249	0.2274
	0.2758

Blew pitot out again at end, same result.

→ Not though at ~centroid, as far in as short pitot would go.

10:43 Flow set at sample point 2b, repeated same process, again steam and liquid coming out of pitot holes at end of both sets, As below

(Set 1)	(Set 2)
0.1936	0.3109
0.2331	0.3281
0.2349	0.2622
0.2771	0.3352
0.5940	0.3408
0.3421	0.3207
0.2735	0.2482
0.4026	0.2691
0.2686	0.3491
0.2541	0.2619

Pitots do not seem to be clogging, repeating process for sample points 1a and 2a on other unit.

10:53 Sample point 2a data set

Set # 1	Set # 2
0.3297	0.2360
0.2660	0.3291
0.2302	0.2537
0.1545	0.2381
0.1386	0.1914
0.2119	0.4060
0.3077	0.1674
0.0959	0.2124
0.2767	0.1955
0.1124	0.1379

11:15 Sample point 1a data set

Set #1	
0.0923	0.0361
0.0778	0.0713
0.0448	0.0522
0.0713	0.0404
0.0465	0.0193
0.0252	0.0250
0.0229	0.0593
0.0241	0.0624
0.0515	0.0489
0.0231	0.0903

Seemingly same result, same amount of water/steam in pitot tip when blew it out, but numbers seemed to be steady

Date: November 6, 2013

To: Marv Lewallen

From: Bob Pernsteiner

Subject: Sampling port daily pressure readings

Summary: The piping that feeds the field pressure gauges on the secondary exhaust line plugs with sawdust and liquor within a few minutes after they are cleared. This piping is the same piping that is slated for use during the source testing scheduled for December. At this point we see no means to keep the line clear long enough to get a valid daily pressure reading, nor a valid sample in December during the testing.

Investigation:

A. Sample 3 is the secondary exhaust line from the Bauer valve to the exhaust collection chamber on #1 M&D. (see PDF file, 1st page)
   a. At 10:38am (11.6.13) we took the field pressure gauge off the line (see photo below) and found the line plugged.
   b. We cleared the ½" diameter line with a welding rod and a plume of steam, water, dilute cooking liquor and raw sawdust spit and dribbled out of the line.
   c. The plume was about 2' in length and the amount of water and sawdust was minor (estimated at less than a couple of milliliters in the minute to minute and a half that the line was open).
   d. The valve was closed and the pressure gauge reinstalled, reading 0 to +2" H2O, or about 0.0 to 0.07 psig. The gauge swing corresponds to the pulse coming from the rotation of the Bauer valve.
   e. We called the control room once we had the gauge on, and the pressure on the exhaust collection chamber read 0.04 psig, indicating we had a fairly good correlation between the field gauge and the chamber.
   f. About 20 minutes later, the line feeding the field pressure gauge was again plugged as indicated by the lack of movement on the pressure gauge.

B. Sample 7 (see photo below) is the secondary exhaust line from the Bauer valve to the exhaust collection chamber on #2 M&D.
   a. Following the investigation on sample #3, we moved to sample #7 and removed the field pressure gauge and unplugged the line and inlet nozzle to the gauge.
   b. Once cleared, here again we had a steam plume (about 2' in length) with the same water, cooking liquor and sawdust spitting and dribbling out of the open line.
   c. Restoring the gauge it had a larger swing than sample #3, and read 0 to +10" H2O, or about 0 to 3 psig.

C. Sample 5 (see photo below) is the line between the exhaust collection chamber and the Kone bin (North side).
   a. We removed the field pressure gauge and found the line plugged.
   b. We cleared the line; restored the gauge and saw a pressure of 0 to 3" H2O.

Conclusion: Rechecking the pressure gauges again at 2:30 pm, or about 3 hours later, both sample #3 and sample #7 appear plugged, as indicated by a lack of movement on the gauge. The sample ports repeatedly plug within a few minutes after they are cleared. The line is laden with steam, cooking liquor and sawdust, and is under about 2” H2O pressure, with swings up to 10” on #2 M&D.

Sample #3 – No.1 M&D secondary line to exhaust collection chamber.

Pressure gauge has been removed and line rodded out. Plume is about 2’

Sample #3 – No.1 M&D secondary line to exhaust collection chamber.

The liquor and sawdust seen on the pipe reflect the material that came out of the line both in the initial unplugging, as well as during the minute or so the line was left open.

Sample #5 – #2 M&D line from exhaust collection chamber to north side of kone bin (referred to as Line “D”)

Exhaust Collection Chamber

Sample #7 - No.2 M&D secondary line to exhaust collection chamber.

On-Site Photographs:

Figure 1

Sample Port 3a - Wet Bulb / Dry BulbTemperature Measurement

Figure 2

Sampling Location for Sample Port 4a

Figure 3

M&D Sawdust Digester No. 1

Figure 4

Sample Port 4b - Wet Bulb / Dry BulbTemperature Measurement

Figure 5

Sampling Location for Sample Port 3b

Figure 6

Sampling Location for Sample Port 2b

Figure 7

Close-Up View of Sample Port 2b
With Debris Flow from Open Port

Figure 8

Sample Port 1b - Wet Bulb / Dry BulbTemperature Measurement

Figure 9

Sample Port 1b - Wet Bulb / Dry BulbTemperature Measurement

Figure 10

Sample Port 1a - Wet Bulb / Dry BulbTemperature Measurement

Figure 11

Sample Port 1a – EPA Method 308 Methanol Sampling Setup

Figure 12

Sampling Locations 1a and 3a

Methanol, Flow Rate and Moisture

Results and Sample Calculations

Field Data

Sample Recovery Field Data & Worksheets

Laboratory Report

Flow Rate and Methanol Results

Client	Clearwater Paper Corp.				12/1/13					Date	
Source	M & D Digesters				JH					Operator	
Location	Lewiston, ID										
					MEW					Analyist/QA	
Definitions	Symbol	PORT	3A	4A	4B	3B	2B	1B	2A	1A	Average
Time, Starting	3-Dec-13	==>	13:35	13:45	14:20	14:35	14:40	14:45	14:53	15:01	
	5-Dec-13	==>					10:43	10:25	10:58	11:15	
	4-Dec-13									9:18	
										11:18	
		Liters								$\boxed{55.01}$	
Volume, Gas sample	Vm	dcf								1.943	
Temperature, Dry gas meter	Tm	°F								$\boxed{64.04}$	
Temperature, Stack gas	Ts	°F	213.0	209.0	213.0	205.0	213.0	217.0	208.0	209.0	
Temperature, Stack Dry Bulb	Tdb	°F	213.0	209.0	213.0	205.0	213.0	217.0	208.0	209.0	
Temperature, Stack Wet Bulb	Twb	°F	213.0	209.0	212.0	200.0	212.0	210.0	205.0	209.0	
Pressure differential across orifice	dH	in H2O									
Average square root velocity pressure	dp^½	in H2O^½					0.550	0.576	0.468	0.216	
Diameter, Nozzle	Dn	in									
Pitot tube coefficient	Cp		0.8121	0.8121	0.8121	0.8121	0.8121	0.8121	0.8121	$\boxed{0.8121}$	
Dry gas meter calibration factor	Y									1.02230	
Pressure, Barometric- SEA LEVEL	Pbar	in Hg	30.17	30.17	30.17	30.17	30.17	30.17	30.17	30.17	
Elevation Correction			-0.74	-0.74	-0.74	-0.74	-0.74	-0.74	-0.74	-0.74	
Pressure, Barometric	Pbar	in Hg	29.43	29.43	29.43	29.43	29.43	29.43	29.43	29.43	
Pressure, Static Stack	Pg	in H2O	0	0	0	0	0	0	0	0	
Time, Total sample	Ø	min	60	60	60	60	60	60	60	120	
Stack Diameter			12	12	12	12	8	8	8	8	
Stack Area	As	in²	113.1	113.1	113.1	113.1	50.3	50.3	50.3	50.3	
Nozzle Area	An	in²									
Volume of condensed water	Vlc	ml								$\boxed{1215.3}$	
Oxygen		% O2	20.95	20.95	20.95	20.95	20.95	20.95	20.95	20.95	
Carbon Dioxide		% CO2	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	
Molecular weight, Dry Stack	Md	lbm / lbmole	28.96	28.96	28.96	28.96	28.96	28.96	28.96	28.96	
Pressure, Absolute Stack	Ps	in Hg	29.43	29.43	29.43	29.43	29.43	29.43	29.43	29.43	
Pressure, avg arcoss orifice	Po	in Hg	29.43	29.43	29.43	29.43	29.43	29.43	29.43	29.43	
Volume, Dry standard gas sample	Vm(std)	dscf	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**1.97**	
Volume, Water Vapor	Vw(std)	scf	0.00	0.00	0.00	0.00	0.00	0.00	0.00	57.21	
Volume Combined		cuft								59.17	
Moisture, % Stack (EPA 4)	Bws(1)	%								$\boxed{\textbf{96.67}}$	
Moisture, % Stack (Psychrometry-Sat)	Bws(2)	%	103.70	95.76	103.70	88.34	103.70	112.17	93.86	$\boxed{\textbf{95.76}}$	
Moisture, % Stack (Theoretical)	Bws(3)	%	na	na	na	na	na	na	na	na	
Moisture, % Stack (Psychrometry)	Bws(4)	%	103.70	95.76	101.67	79.69	101.67	97.69	88.32	95.76	
Moisture, % Stack (Predicted)	Bws(5)	%	na	na	na	na	na	na	na	na	
Mole Fraction dry Gas	mfg		-4%	4%	-2%	20%	-2%	2%	12%	**3.33%**	
Molecular weight, Wet Stack	Ms	lbm / lbmole	17.61	18.48	17.83	20.24	17.83	18.27	19.29	18.38	
Velocity, Stack gas	vs	fpm	0	0	0	0	2,596	2,690	2,112	1,000	
Volumetric Flowrate, Actual	Qa	acf/min	0	0	0	0	906	939	737	349	
Volumetric Flowrate, Dry Standard	Qsw	wscf/min	0	0	0	0	699	720	573	271	
Volumetric Flowrate, Dry Standard	Qsd	dscf/min	0	0	0	0	-12	17	67	**9.0**	
		wscf/hr								16261.9	
					METHANOL						
Impinger										9800	
Silica Gel Tube Front										110	
Silica Gel Tube Back										77	
Total		**ug**								9987	
	mn	mg								9.99	
Grain Loading, Actual	cg	gr / dscf								0.078	
		mg / dscm								179.20	
		ppmv								134.54	
	Ct	lbm / hr								0.006051	
		gm / hr								3	
		ODTP/DAY								240	
Production Pulp		ODT/hr								10	
		lbm-MeOH/ODTP								0.00061	

Client: Clearwater Paper Corp. Date 12/4/2013

Source MSD Digester No. 1 P41a Project # 4980 Run # 1

Molecular Weights (lb/lbmol):

CO_2=44.01	O_2=31.999	N_2+Ar=28.154	H_2O=18.015	atm=28.965

Constants:

Pstd(1)=29.92129 in Hg	Tstd=527.67 °R	Kp=5129.4	C2=816.5455inHg in²/°R ft²

Volume Gas Sample, L: 55.01

Volume Gas Sample at Standard Conditions, dsm³:

$$Vm(std), dsm^3 = \frac{L \times 0.001\frac{m^3}{L} \times Tstd \times Barometric\,Pressure(Pb)}{Pstd(1) \times Ta \circ R}$$

$$= \frac{55.01\, L \times 0.001\frac{m^3}{L} \times 527.67 \circ R \times 29.43\ inHg}{29.9213 inHg \times (64 \circ F + 459.67) \circ R} = 0.0545\ dsm^3$$

Analyte: Methanol **Lab Results, µg:** 9800 **impinger +** 110 **SG Front**

+ 77 **SG Back =** 9987 **Total µg**

$$\mu g/m^3 = \mu g \div m^3 = \frac{9987\ \mu g}{0.0545 dsm^3} = 183247.7\ \mu g/m^3$$

Concentration, ppbv:

$$ppbv = \frac{\mu g}{m^3} \times 24.0548 \div molecularweight, where$$

$$24.0548 = \left[10^9 \div 2116.2\frac{lbf}{ft^2} \times 1545.33\frac{ftlbf}{lbmol \circ R} \times 527.7 \circ R\right] \div \left(35.3147\frac{ft^3}{m^3} \times 453592370\frac{\mu g}{lb}\right)$$

$$= 183247.7\frac{\mu g}{m^3} \times 24.0548 \div 32.04\frac{lb}{lb-mol} = 137577\ ppbv \quad = 137.6\ ppmV$$

Mass Emissions, lb/hr:

$$E\frac{lb}{hr} = \frac{60\frac{min}{hr} \times 137.6\ ppmv \times 32.04\frac{lb}{lbmol} \times 2116.22\frac{lbf}{ft^2} \times 8.96\frac{dscf}{min}}{10^6 \times 1545.33\frac{ftlbf}{lbmol \circ R} \times 527.7 \circ Rstd} = 0.00615\frac{lb}{hr}$$

$0.00615 \frac{lb}{hr} \div 10 \frac{ODTP}{hr} = 0.000615 \frac{lb\text{-}MeOH}{ODTP}$

$240\ ODTP/day \times \frac{day}{24hr} = 10\ \frac{ODTP}{hr}$

Client: Clearwater Paper Corp. Date 12/4/2013

Source M & D Digester No1 Point 1A Project # 4980 Run # 1

Molecular Weights (lb/lbmol):

CO_2=44.0	O_2=32.0	N_2+Ar=28.0	H_2O=18.0	atm=29.0

Constants:

Pstd(1)=29.92 in Hg	Tstd=528 °R	Kp=5129.4	C2=816.5455inHg in^2/°R ft^2

Pressure, Absolute Stack (Ps):

$$Ps, inHg = P_{Barometric} + \frac{P_{static}}{13.6} = \underline{29.43}\ inHg + \frac{\underline{\ —\ }\ in\ H2O}{13.6} = \underline{29.43}\ inHg$$

(corr. for elevation)

Moisture, % Stack Gas (bws) by Psychrometry: 96.7 %

Mole Fraction Gas (mfg):
$$1 - \frac{bws}{100} = 1 - \frac{\underline{96.7}\%}{100} = \underline{0.033}$$

Molecular Weight, Dry, Stack (Md): Ambient Conditions, Md = 29.0 lb/lb mol

Molecular Weight, Wet, Stack (Ms):

$$Ms\frac{lb}{lbmol} = (Md \times mfg) + (MolWtH_2O \times (1 - mfg)) = \left(\underline{29}\ \frac{lb}{lbmol} \times \underline{0.033}\right) + (18.0 \times (1 - \underline{.967}))$$

$$= \underline{18.36}\ \frac{lb}{lbmol}$$

Stack gas (vs): $Ts = \underline{209} \circ F + 459.7 = \underline{668.7} \circ R$

$$= vs\frac{feet}{min} = Kp \times Cp \times dp\sqrt{inH_2O} \times \sqrt{\frac{Ts \circ R}{Ps \times Ms}}$$

$$= 5129.4\ ft/min \ldots \times \underline{.8121} \times \underline{0.216}\ dp\sqrt{inH_2O} \times \sqrt{\frac{\underline{668.7} \circ R}{\underline{29.43}\ inHg \times \underline{18.36}\ \frac{lb}{lbmol}}} = \underline{1000.9}\ \frac{ft}{min}$$

Flow Rate, Actual (Qa): 8" ϕ

$$Qa\frac{actualCubicFeet}{min} = \frac{AreaStack \times vs}{144} = \frac{\underline{50.3}\ in^2 \times \underline{1000.9}\ \frac{ft}{min}}{144} = \underline{349.4}\ acfm$$

Flow Rate, Dry Standard (Qsd):

$$Qsd\frac{dryStdFt^3}{min} = \frac{Qa \times Tstd \times mfg \times Ps}{Pstd(1) \times Ts \circ R} = \frac{\underline{349.4}\ acfm \times 528 \circ R \times \underline{.033} \times \underline{29.43}\ inHg}{29.92 inHg \times \underline{668.7} \circ R}$$

$$= \underline{8.96}\ \frac{dscf}{min}$$

Field Data Sheet

13585 NE Whitaker Way
Portland, OR 97230
Phone (503) 255-5050
Fax (503) 255-0505

Client: Clearwater
Plant: Lewiston DD
Location: 1A
Sample Location:

Date	12/4/13
Test Method	308
Concurrent Testing	—
Run #	1
Operator	KPK
Support	TL/JS
Temperature, Ambient (Ta)	
Moisture	95-100% Tdb Twb
Press., Static (Pstat)	
Press., Bar (Pb)	29.8
Cyclonic Flow Expected ?	If yes, avg. null angle degrees

Glass Nozzle Measurements
1 —
2 —
3 —

ALT-011
Std TC (ID/°F) —
Stack TC (ID/°F) —
Continuity Check ↑ or ↓

Probe — (g / s) Cp — Heat Set — °F
Post-Test Pitot Inspection (NC=no change, D=damaged)
Pitot Lk Rate in H2O@in H2O Pre: Hi — @ — Post — @ — ; Lo — @ — — @ —
Nozzle — Oven — Imp. Outlet —
Filter — Heat Set — °F
Meter Box 4 dH@ Y 1.02230
Meter Leak Check Pretest: .01 cfm 25 inHg; Post: .01 cfm 5 inHg

Traverse Point Number	Sampling Time min (dt)	Clock Time (24 hr)	Dry Gas Meter Reading ~~ft3~~ LPM (Vm)	Velocity Head in H2O (dPs)	Orifice Pressure in H2O DESIRED	Orifice Pressure H2O ACTUAL (dH)	STACK °F (Ts)	PROBE °F (Tp)	OVEN Filter °F (To)	IMPINGER Outlet °F (Ti)	METER Inlet/Avg. °F (Tm-in)	METER Outlet °F (Tm-out)	Pump Vacuum inHg (Pv)
							Amb:	Amb:	Amb:	Amb:	Amb:	Amb:	
		918	7675.00										
1	5		7676.90			.5 LPM					58	58	1
2	10		7678.75								58	57	1
3	15		7681.00								59	59	1
4	20		7683.58								59	58	1
5	25		7686.05								60	60	1
6	30		7689.70								62	61	1
7	35		7693.20								62	62	1
8	40		7695.24								64	63	1
9	45		7696.80								65	63	1
10	50		7699.00								65	64	1
11	55		7701.56								65	65	1
12	60		7703.90								66	65	1
13	65		7706.50								66	65	1
14	70		7708.89								67	66	1
15	75		7711.22								67	65	1
16	80		7713.26								68	65	1
17	85		—.—								68	66	1
18	90		7719.85								67	66	1
19	95		7721.15								67	66	1
20	100		7723.72								67	66	1
21	105		7725.59								68	66	1
22	110		7726.95								68	66	1
23	115		7728.40								67	66	1
24	120	1118	7730.01								67	66	1
25													

Notes:

HORIZON ENGINEERING LLC
13585 NE Whitaker Way • Portland, OR 97230
Phone (503) 255-5050 • Fax (503) 255-0505
www.horizonengineering.com

Sample Recovery Worksheet

Client & Source: Clearwater Lewiston ID   Test Date: 12/4/13

Sample Location: 1A   Initials: KRK

Balance Calibration (1000, 500, 200 g)
Need one per each 3-run test: 1000 / 501 / 201

IMPINGER CONTENTS	RUN 1	RUN 2	RUN 3
Container, condensate & rinse, grams	1A	3A	
Container & condensate, grams	675/681/685/333	694/653	
Empty container, grams	264/266/266/265	264/266	
Initial volume, ml	100	100	
Initial contents	DI H_2O	DI H_2O	
Initial concentration	100 %	100 %	
Net water gain, ml			
Condensate appearance			
Level marked on container			
pH of condensate			
Rinsed with			
Solvent Name and Lot No.			
Solvent Name and Lot No.			

SILICA GEL (w/impinger, top off)			
Final weight, grams			
Initial weight, grams	520	520	520
Net gain, grams			

TOTAL MOISTURE GAIN			
Impingers and silica gel, grams			

FILTERS			
Front filter number			
Front filter appearance			
Back filter number			

Shared files\Field\Data Sheets\Sample Recovery\Sample Recovery_v1.pdf

Sample Recovery / Moisture Catch

Clearwater Paper Corp. 1-Dec-13
M & D Digesters JH
Lewiston, ID

MEW

Definitions		Symbol	Units	1	
Impinger Contents					
		Impinger, Contents,Condensate & Rinse (2)			
		Impinger, Contents,Condensate & Rinse			
		Impinger, Contents & Condensate	g	2374.0	
	spg (g/ml)	Impinger	g	1061.0	
	0.99823	H2O	ml	100.0	
	0.9982	Condensate	g	1213.2	
	0.9982	Water Rinse	g		
	0.7908	Acetone Rinse	g		
	1.3266	DCM Rinse	g		
		Sample Correction Volume	ml	100.0	
		Sample sent to lab	ml	1315.3	
		Sample received by lab	ml		
		Diff			
Total Moisture Gain		Condensate + Silica Gel gain	g	1213.18	
Vlc		**Net Moisture Gain**	ml	1215.33	

CLR_WATERx.xls

December 27, 2013 Analytical Report for Service Request No: K1313377

Joe Heffernan
Horizon Engineering, LLC
13585 NE Whitaker Way
Portland, OR 97230

RE: Clearwater Paper Corp./4980

Dear Joe:

Enclosed are the results of the samples submitted to our laboratory on December 10, 2013. For your reference, these analyses have been assigned our service request number K1313377.

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. The test results meet requirements of the current NELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. All results are intended to be considered in their entirety, and ALS Group USA Corp. dba ALS Environmental (ALS) is not responsible for use of less than the complete report. Results apply only to the items submitted to the laboratory for analysis and individual items (samples) analyzed, as listed in the report.

Please call if you have any questions. My extension is 3293. You may also contact me via Email at Shar.Samy@alsglobal.com.

Respectfully submitted,

ALS Group USA Corp. dba ALS Environmental

Shar Samy, Ph.D.
Project Manager

SS/mj Page 1 of 20

Acronyms

ASTM	American Society for Testing and Materials
A2LA	American Association for Laboratory Accreditation
CARB	California Air Resources Board
CAS Number	Chemical Abstract Service registry Number
CFC	Chlorofluorocarbon
CFU	Colony-Forming Unit
DEC	Department of Environmental Conservation
DEQ	Department of Environmental Quality
DHS	Department of Health Services
DOE	Department of Ecology
DOH	Department of Health
EPA	U. S. Environmental Protection Agency
ELAP	Environmental Laboratory Accreditation Program
GC	Gas Chromatography
GC/MS	Gas Chromatography/Mass Spectrometry
LOD	Limit of Detection
LOQ	Limit of Quantitation
LUFT	Leaking Underground Fuel Tank
M	Modified
MCL	Maximum Contaminant Level is the highest permissible concentration of a substance allowed in drinking water as established by the USEPA.
MDL	Method Detection Limit
MPN	Most Probable Number
MRL	Method Reporting Limit
NA	Not Applicable
NC	Not Calculated
NCASI	National Council of the Paper Industry for Air and Stream Improvement
ND	Not Detected
NIOSH	National Institute for Occupational Safety and Health
PQL	Practical Quantitation Limit
RCRA	Resource Conservation and Recovery Act
SIM	Selected Ion Monitoring
TPH	Total Petroleum Hydrocarbons
tr	Trace level is the concentration of an analyte that is less than the PQL but greater than or equal to the MDL.

Inorganic Data Qualifiers

* The result is an outlier. See case narrative.
# The control limit criteria is not applicable. See case narrative.
B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
E The result is an estimate amount because the value exceeded the instrument calibration range.
J The result is an estimated value.
U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X See case narrative.
Q See case narrative. One or more quality control criteria was outside the limits.
H The holding time for this test is immediately following sample collection. The samples were analyzed as soon as possible after receipt by the laboratory.

Metals Data Qualifiers

The control limit criteria is not applicable. See case narrative.
J The result is an estimated value.
E The percent difference for the serial dilution was greater than 10%, indicating a possible matrix interference in the sample.
M The duplicate injection precision was not met.
N The Matrix Spike sample recovery is not within control limits. See case narrative.
S The reported value was determined by the Method of Standard Additions (MSA).
U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
W The post-digestion spike for furnace AA analysis is out of control limits, while sample absorbance is less than 50% of spike absorbance.
i The MRL/MDL or LOQ/LOD is elevated due to a matrix interference.
X See case narrative.
+ The correlation coefficient for the MSA is less than 0.995.
Q See case narrative. One or more quality control criteria was outside the limits.

Organic Data Qualifiers

* The result is an outlier. See case narrative.
# The control limit criteria is not applicable. See case narrative.
A A tentatively identified compound, a suspected aldol-condensation product.
B The analyte was found in the associated method blank at a level that is significant relative to the sample result as defined by the DOD or NELAC standards.
C The analyte was qualitatively confirmed using GC/MS techniques, pattern recognition, or by comparing to historical data.
D The reported result is from a dilution.
E The result is an estimated value.
J The result is an estimated value.
N The result is presumptive. The analyte was tentatively identified, but a confirmation analysis was not performed.
P The GC or HPLC confirmation criteria was exceeded. The relative percent difference is greater than 40% between the two analytical results.
U The analyte was analyzed for, but was not detected ("Non-detect") at or above the MRL/MDL.
DOD-QSM 4.2 definition : Analyte was not detected and is reported as less than the LOD or as defined by the project. The detection limit is adjusted for dilution.
i The MRL/MDL or LOQ/LOD is elevated due to a chromatographic interference.
X See case narrative.
Q See case narrative. One or more quality control criteria was outside the limits.

Additional Petroleum Hydrocarbon Specific Qualifiers

F The chromatographic fingerprint of the sample matches the elution pattern of the calibration standard.
L The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of lighter molecular weight constituents than the calibration standard.
H The chromatographic fingerprint of the sample resembles a petroleum product, but the elution pattern indicates the presence of a greater amount of heavier molecular weight constituents than the calibration standard.
O The chromatographic fingerprint of the sample resembles an oil, but does not match the calibration standard.
Y The chromatographic fingerprint of the sample resembles a petroleum product eluting in approximately the correct carbon range, but the elution pattern does not match the calibration standard.
Z The chromatographic fingerprint does not resemble a petroleum product.

ALS Group USA Corp. dba ALS Environmental (ALS) - Kelso
State Certifications, Accreditations, and Licenses

Agency	Web Site	Number
Alaska DEC UST	http://dec.alaska.gov/applications/eh/ehllabreports/USTLabs.aspx	UST-040
Arizona DHS	http://www.azdhs.gov/lab/license/env.htm	AZ0339
Arkansas - DEQ	http://www.adeq.state.ar.us/techsvs/labcert.htm	88-0637
California DHS (ELAP)	http://www.cdph.ca.gov/certlic/labs/Pages/ELAP.aspx	2286
DOD ELAP	http://www.denix.osd.mil/edqw/Accreditation/AccreditedLabs.cfm	L12-28
Florida DOH	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E87412
Georgia DNR	http://www.gaepd.org/Documents/techguide_pcb.html#cel	881
Hawaii DOH	Not available	-
Idaho DHW	http://www.healthandwelfare.idaho.gov/Health/Labs/CertificationDrinkingWaterLabs/tabid/1833/Default.aspx	-
Indiana DOH	http://www.in.gov/isdh/24859.htm	C-WA-01
ISO 17025	http://www.pjlabs.com/	L12-27
Louisiana DEQ	http://www.deq.louisiana.gov/portal/DIVISIONS/PublicParticipationandPermitSupport/LouisianaLaboratoryAccreditationProgram.aspx	3016
Maine DHS	Not available	WA0035
Michigan DEQ	http://www.michigan.gov/deq/0,1607,7-135-3307_4131_4156---,00.html	9949
Minnesota DOH	http://www.health.state.mn.us/accreditation	053-999-368
Montana DPHHS	http://www.dphhs.mt.gov/publichealth/	CERT0047
Nevada DEP	http://ndep.nv.gov/bsdw/labservice.htm	WA35
New Jersey DEP	http://www.nj.gov/dep/oqa/	WA005
North Carolina DWQ	http://www.dwqlab.org/	605
Oklahoma DEQ	http://www.deq.state.ok.us/CSDnew/labcert.htm	9801
Oregon – DEQ (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	WA200001
South Carolina DHEC	http://www.scdhec.gov/environment/envserv/	61002
Texas CEQ	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704427-08-TX
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C1203
Wisconsin DNR	http://dnr.wi.gov/	998386840
Wyoming (EPA Region 8)	http://www.epa.gov/region8/water/dwhome/wyomingdi.html	-
Kelso Laboratory Website	www.alsglobal.com	NA

Analyses were performed according to our laboratory's NELAP-approved quality assurance program. A complete listing of specific NELAP-certified analytes, can be found in the certification section at www.caslab.com or at the accreditation bodies web site

Please refer to the certification and/or accreditation body's web site if samples are submitted for compliance purposes. The states highlighted above, require the analysis be listed on the state certification if used for compliance purposes and if the method/anlayte is offered by that state.

ALS ENVIRONMENTAL

Client:	Horizon Engineering, LLC	**Service Request No.:**	K1313377
Project:	Clearwater Paper Corp./4980	**Date Received:**	12/10/13
Sample Matrix:	Water and Misc. Solid		

Case Narrative

All analyses were performed consistent with the quality assurance program of ALS Environmental. This report contains analytical results for samples designated for Tier II data deliverables. When appropriate to the method, method blank results have been reported with each analytical test. Surrogate recoveries have been reported for all applicable organic analyses. Additional quality control analyses reported herein include: Matrix/Duplicate Matrix Spike (MS/DMS), and Laboratory Control Sample (LCS).

Sample Receipt

Two water samples and four misc. solid samples were received for analysis at ALS Environmental on 12/10/13. The samples were received in good condition and consistent with the accompanying chain of custody form. The samples were stored in a refrigerator at 4ºC upon receipt at the laboratory.

Methanol Impingers by EPA Method 308

Matrix Spike Recovery Exceptions:
The control criteria for matrix spike recovery of Methanol for sample M+D No1/1A-R1 were not applicable. The analyte concentration in the sample was significantly higher than the added spike concentration, preventing accurate evaluation of the spike recovery.

No other anomalies associated with the analysis of these samples were observed.

Methanol Silica-gel Tubes by EPA Method 308

Sample Notes and Discussion:
Insufficient sample volume was received to perform a Matrix Spike/Matrix Spike Duplicate (MS/MSD). A Laboratory Control Sample/Duplicate Laboratory Control Sample (LCS/DLCS) was analyzed and reported in lieu of the MS/MSD for these samples.

No other anomalies associated with the analysis of these samples were observed.

Approved by____

CHAIN OF CUSTODY

ALS Environmental

1317 South 13th Ave., Kelso, WA 98626 | 360.577.7222 | 800.695.7222 | 360.636.1068 (fax)

SR# K1313774 69

PAGE 1 OF 1 COC#

PROJECT NAME: Clearwater Paper Corp.
PROJECT NUMBER: 4980
PROJECT MANAGER: Joseph Heffernan III
COMPANY NAME: Horizon Engineering
ADDRESS: 13585 NE Whitaker Way
CITY/STATE/ZIP: Portland OR 97230
E-MAIL ADDRESS: mheffernan@horizonengineering.com
PHONE # 503 255-5050 FAX # 503-255-0505
SAMPLER'S SIGNATURE:

Analysis columns: NUMBER OF CONTAINERS; Semivolatile Organics by GC/MS 625☐ 8270☐ 8270LL☐ SIM PAH☐; Volatile Organics 624☐ 8260☐ 8021☐ BTEX☐; Hydrocarbons (*see below) Gas☐ Diesel☐ Oil☐; Oil & Grease/TRPH 1664 HEM☐ 1664 SGT☐; PCBs Aroclors☐ Congeners☐; Pesticides/Herbicides 608☐ 8081☐ 8141☐ 8151☐; Chlorophenolics - 8151M Tri☐ Tetra☐ PCP☐; Metals, Total or Dissolved (See List below); Cyanide☐ Hex-Chrom☐; (circle) pH, Cond., Cl, SO_4, PO_4, F, NO_2, NO_3, BOD, TSS, TDS, Turb.; (circle) NH_3-N, COD, TKN, TOC, DOC, NO_2+NO_3, T-Phos; TOX 9020☐ AOX 1650☐ 506☐; Alkalinity☐ CO_3☐ HCO_3☐; Dioxins/Furans 1613☐ 8290☐; Dissolved Gases RSK 175☐ Methane☐ Ethane☐ Ethene☐ CO_2☐; EPA 308 MeOH

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS	EPA 308 MeOH	REMARKS
MtD No1/1A-R1	12/4/13	—		Aqu	1	✓	aliquot
MtD No1/1A-R1	12/4/13	—		Tube	1	✓	FH/BH sep.
H_2O Blank	12/9/13	—		Aqu	1	✓	
Tube Blank	12/9/13	—		Tube	1	✓	FH/BH sep.

REPORT REQUIREMENTS

___ I. Routine Report: Method Blank, Surrogate, as required

X II. Report Dup., MS, MSD as required

___ III. CLP Like Summary (no raw data)

___ IV. Data Validation Report

___ V. EDD

INVOICE INFORMATION

P.O. # 4980

Bill To: E Bagwell

TURNAROUND REQUIREMENTS

___ 24 hr. ___ 48 hr.

___ 5 day

X Standard (15 working days)

___ Provide FAX Results

Requested Report Date

Circle which metals are to be analyzed:

Total Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

*INDICATE STATE HYDROCARBON PROCEDURE: AK CA WI NORTHWEST OTHER: ________ (CIRCLE ONE)

SPECIAL INSTRUCTIONS/COMMENTS:

☐ Sample Shipment contains USDA regulated soil samples (check box if applicable)

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
Signature: [signature] Date/Time: 12/10/13 11:52	Signature: [signature] Date/Time: 12/10/13 11:52	Signature: Date/Time:	Signature: [signature] Date/Time: 12/10/13 1315
Printed Name: Joe Heffernan Firm: Horizon	Printed Name: [illegible] Firm: ALS	Printed Name: Firm:	Printed Name: Szurz F Firm: ALS

HORIZON ENGINEERING 13-4980

ALS

PC Shar

Cooler Receipt and Preservation Form

Client / Project: Horizon Eng. Service Request K13 13377

Received: 12/10/13 Opened: 12/10/13 By: [illegible] Unloaded: 12/10/13 By: [illegible]

1. Samples were received via? *Mail* *Fed Ex* *UPS* *DHL* *PDX* *Courier* *Hand Delivered*
2. Samples were received in: (circle) *Cooler* *Box* *Envelope* *Other* ______ *NA*
3. Were custody seals on coolers? NA Y N If yes, how many and where? ______

   If present, were custody seals intact? Y N If present, were they signed and dated? Y N

Raw Cooler Temp	Corrected. Cooler Temp	Raw Temp Blank	Corrected Temp Blank	Corr. Factor	Thermometer ID	Cooler/COC ID NA	Tracking Number NA	Filed
3.8	3.8	—	—	Ø	336			

4. Packing material: *Inserts* *Baggies* *Bubble Wrap* *Gel Packs* *Wet Ice* *Dry Ice* *Sleeves* ______
5. Were custody papers properly filled out (ink, signed, etc.)? NA Y N
6. Did all bottles arrive in good condition (unbroken)? *Indicate in the table below.* NA Y N
7. Were all sample labels complete (i.e analysis, preservation, etc.)? NA Y N
8. Did all sample labels and tags agree with custody papers? *Indicate major discrepancies in the table on page 2.* NA Y N
9. Were appropriate bottles/containers and volumes received for the tests indicated? NA Y N
10. Were the pH-preserved bottles (*see SMO GEN SOP*) received at the appropriate pH? *Indicate in the table below* NA Y N
11. Were VOA vials received without headspace? *Indicate in the table below.* NA Y N
12. Was C12/Res negative? NA Y N

Sample ID on Bottle	Sample ID on COC	Identified by:

Sample ID	Bottle Count Bottle Type	Out of Temp	Head-space	Broke	pH	Reagent	Volume added	Reagent Lot Number	Initials	Time

Notes, Discrepancies, & Resolutions: ______

Analytical Results

Client: Horizon Engineering, LLC
Project: Clearwater Paper Corp./4980
Sample Matrix: Water

Service Request: K1313377
Date Collected: 12/04/2013
Date Received: 12/10/2013

Methanol Impingers

Sample Name: M+D No1/1A-R1
Lab Code: K1313377-001

Units: ug
Basis: NA

Extraction Method: METHOD
Analysis Method: 308

Level: Low

Analyte Name	Result	Q	MRL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Methanol	**9800**		22	1	12/12/13	12/12/13	KWG1313693	

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	Horizon Engineering, LLC	**Service Request:**	K1313377
Project:	Clearwater Paper Corp./4980	**Date Collected:**	12/09/2013
Sample Matrix:	Water	**Date Received:**	12/10/2013

Methanol Impingers

Sample Name:	H2O Blank	**Units:**	ug
Lab Code:	K1313377-004	**Basis:**	NA
Extraction Method:	METHOD	**Level:**	Low
Analysis Method:	308		

Analyte Name	Result	Q	MRL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Methanol	ND	U	22	1	12/12/13	12/12/13	KWG1313693	

Comments:

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	Horizon Engineering, LLC	**Service Request:**	K1313377
Project:	Clearwater Paper Corp./4980	**Date Collected:**	NA
Sample Matrix:	Water	**Date Received:**	NA

Methanol Impingers

Sample Name:	Method Blank	**Units:**	ug
Lab Code:	KWG1313693-4	**Basis:**	NA
Extraction Method:	METHOD	**Level:**	Low
Analysis Method:	308		

Analyte Name	Result	Q	MRL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Methanol	ND	U	0.50	1	12/12/13	12/12/13	KWG1313693	

Comments:

Client: Horizon Engineering, LLC
Project: Clearwater Paper Corp./4980
Sample Matrix: Water

Service Request: K1313377
Date Extracted: 12/12/2013
Date Analyzed: 12/12/2013

Matrix Spike Summary
Methanol Impingers

Sample Name: M+D No1/1A-R1
Lab Code: K1313377-001
Extraction Method: METHOD
Analysis Method: 308

Units: ug
Basis: NA
Level: Low
Extraction Lot: KWG1313693

		M+D No1/1A-R1MS KWG1313693-1 Matrix Spike			
Analyte Name	**Sample Result**	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**
Methanol	9800	12000	2150	101 #	70-130

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

QA/QC Report

Client:	Horizon Engineering, LLC	**Service Request:**	K1313377
Project:	Clearwater Paper Corp./4980	**Date Extracted:**	12/12/2013
Sample Matrix:	Water	**Date Analyzed:**	12/12/2013

Duplicate Sample Summary
Methanol Impingers

Sample Name:	M+D No1/1A-R1	**Units:**	ug
Lab Code:	K1313377-001	**Basis:**	NA
Extraction Method:	METHOD	**Level:**	Low
Analysis Method:	308	**Extraction Lot:**	KWG1313693

			M+D No1/1A-R1DUP KWG1313693-2 Duplicate Sample			
Analyte Name	**MRL**	**Sample Result**	**Result**	**Average**	**Relative Percent Difference**	**RPD Limit**
Methanol	22	9800	9700	9800	2	30

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Client: Horizon Engineering, LLC
Project: Clearwater Paper Corp./4980
Sample Matrix: Water

Service Request: K1313377
Date Extracted: 12/12/2013
Date Analyzed: 12/12/2013

Lab Control Spike Summary
Methanol Impingers

Extraction Method: METHOD
Analysis Method: 308

Units: ug
Basis: NA
Level: Low
Extraction Lot: KWG1313693

	Lab Control Sample KWG1313693-3 Lab Control Spike			
Analyte Name	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**
Methanol	50.8	50.0	102	70-130

Results flagged with an asterisk (*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

ALS Group USA, Corp. dba ALS Environmental

Analytical Results

Client:	Horizon Engineering, LLC	**Service Request:**	K1313377
Project:	Clearwater Paper Corp./4980	**Date Collected:**	12/04/2013
Sample Matrix:	Misc. solid	**Date Received:**	12/10/2013

Methanol Silica-gel Tubes

Sample Name:	M+D No1/1A-R1 Silica Gel Tube - Front	**Units:**	ug
Lab Code:	K1313377-002	**Basis:**	Wet
Extraction Method:	METHOD	**Level:**	Low
Analysis Method:	308		

Analyte Name	Result	Q	MRL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Methanol	**110**		1.5	1	12/17/13	12/17/13	KWG1313821	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Ethanol	139	50-150	12/17/13	Acceptable

Comments:

Analytical Results

Client:	Horizon Engineering, LLC	**Service Request:**	K1313377
Project:	Clearwater Paper Corp./4980	**Date Collected:**	12/04/2013
Sample Matrix:	Misc. solid	**Date Received:**	12/10/2013

Methanol Silica-gel Tubes

Sample Name:	M+D No1/1A-R1 Silica Gel Tube - Back	**Units:**	ug
Lab Code:	K1313377-003	**Basis:**	Wet
Extraction Method:	METHOD	**Level:**	Low
Analysis Method:	308		

Analyte Name	Result	Q	MRL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Methanol	**77**		1.5	1	12/17/13	12/17/13	KWG1313821	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Ethanol	138	50-150	12/17/13	Acceptable

Comments:

Analytical Results

Client:	Horizon Engineering, LLC	**Service Request:**	K1313377
Project:	Clearwater Paper Corp./4980	**Date Collected:**	12/09/2013
Sample Matrix:	Misc. solid	**Date Received:**	12/10/2013

Methanol Silica-gel Tubes

Sample Name:	Blank Silica Gel Tube - Front	**Units:**	ug
Lab Code:	K1313377-005	**Basis:**	Wet
Extraction Method:	METHOD	**Level:**	Low
Analysis Method:	308		

Analyte Name	Result	Q	MRL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Methanol	ND	U	1.5	1	12/17/13	12/17/13	KWG1313821	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Ethanol	95	50-150	12/17/13	Acceptable

Comments:

Analytical Results

Client:	Horizon Engineering, LLC	**Service Request:**	K1313377
Project:	Clearwater Paper Corp./4980	**Date Collected:**	12/09/2013
Sample Matrix:	Misc. solid	**Date Received:**	12/10/2013

Methanol Silica-gel Tubes

Sample Name:	Blank Silica Gel Tube - Back	**Units:**	ug
Lab Code:	K1313377-006	**Basis:**	Wet
Extraction Method:	METHOD	**Level:**	Low
Analysis Method:	308		

Analyte Name	Result	Q	MRL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Methanol	ND	U	1.5	1	12/17/13	12/17/13	KWG1313821	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Ethanol	87	50-150	12/17/13	Acceptable

Comments:

Analytical Results

Client:	Horizon Engineering, LLC	**Service Request:**	K1313377
Project:	Clearwater Paper Corp./4980	**Date Collected:**	NA
Sample Matrix:	Misc. solid	**Date Received:**	NA

Methanol Silica-gel Tubes

Sample Name:	Method Blank	**Units:**	ug
Lab Code:	KWG1313821-3	**Basis:**	Wet
Extraction Method:	METHOD	**Level:**	Low
Analysis Method:	308		

Analyte Name	Result	Q	MRL	Dilution Factor	Date Extracted	Date Analyzed	Extraction Lot	Note
Methanol	ND	U	1.5	1	12/17/13	12/17/13	KWG1313821	

Surrogate Name	%Rec	Control Limits	Date Analyzed	Note
Ethanol	95	50-150	12/17/13	Acceptable

Comments:

QA/QC Report

Client: Horizon Engineering, LLC
Service Request: K1313377
Project: Clearwater Paper Corp./4980
Sample Matrix: Misc. solid

Surrogate Recovery Summary
Methanol Silica-gel Tubes

Extraction Method: METHOD
Units: Percent
Analysis Method: 308
Level: Low

Sample Name	Lab Code	Sur1
M+D No1/1A-R1 Silica Gel Tube - Fr	K1313377-002	139
M+D No1/1A-R1 Silica Gel Tube - Ba	K1313377-003	138
Blank Silica Gel Tube - Front	K1313377-005	95
Blank Silica Gel Tube - Back	K1313377-006	87
Method Blank	KWG1313821-3	95
Lab Control Sample	KWG1313821-1	104
Duplicate Lab Control Sample	KWG1313821-2	105

Surrogate Recovery Control Limits (%)

Sur1 = Ethanol 50-150

Results flagged with an asterisk (*) indicate values outside control criteria.

Results flagged with a pound (#) indicate the control criteria is not applicable.

QA/QC Report

Client:	Horizon Engineering, LLC	**Service Request:**	K1313377
Project:	Clearwater Paper Corp./4980	**Date Extracted:**	12/17/2013
Sample Matrix:	Misc. solid	**Date Analyzed:**	12/17/2013

Lab Control Spike/Duplicate Lab Control Spike Summary
Methanol Silica-gel Tubes

Extraction Method:	METHOD	**Units:**	ug
Analysis Method:	308	**Basis:**	Wet
		Level:	Low
		Extraction Lot:	KWG1313821

	Lab Control Sample KWG1313821-1 **Lab Control Spike**			Duplicate Lab Control Sample KWG1313821-2 **Duplicate Lab Control Spike**					
Analyte Name	**Result**	**Spike Amount**	**%Rec**	**Result**	**Spike Amount**	**%Rec**	**%Rec Limits**	**RPD**	**RPD Limit**
Methanol	155	150	103	156	150	104	50-150	1	30

Results flagged with an asterisk (*) indicate values outside control criteria.

Percent recoveries and relative percent differences (RPD) are determined by the software using values in the calculation which have not been rounded.

Calibration Information

Liter Meter
Standard Meter
Pitots
Shortridge Micromanometer
Thermocouples and Indicators
Barometer

Biannual Liter Meter Calibration

Method	EPA M-5 #7.2	Date	7/24/13		
Location	Horizon Shop	Pb=	30.1	(in Hg)	
Meter Box ID	LBM4	Ta=	72	(°F)	
Meter ID	2835271	Tamb	531.67	(°R)	
calibrated by	PT	Y=	1.0059	Standard Meter	
		Leak check			
		Rate	Negative	0 in/min @	27 inches Hg
			Positive	0 in/min @	4.6 in H_2O

6mo.	New	Change
1/17/13	7/24/13	(+/-)
1.0079	1.02230	1.4%

		FIELD METER						STANDARD METER						Time		Allowable
	Meter Pressure H20"	Meter (liters)	Net (liters)	Tdi (°F)	Tdo (°F)	To (°R)	Tm (°R)	Meter (liters)	Net (liters)	Tdi (°F)	Tdo (°F)	To (°R)	Tm (°R)	t (min)	Y	Y 0.02
Initial	4.0	6416.40	8.92	75	73	532.67	533.17	6216.21	9.13	71	72	532.17	531.92	3.0	1.02201	0.0003
Final		6425.32		73	73			6225.34		73	73					pass
Initial	2.4	6425.32	7.94	73	73	532.67	532.92	6225.34	8.08	73	73	532.67	532.67	4.0	1.01815	0.0042
Final		6433.26		74	73			6233.42		73	73					pass
Initial	1.6	6433.26	7.58	74	74	533.67	533.67	6233.42	7.76	74	73	532.67	533.17	5.0	1.02674	0.0044
Final		6440.84		74	74			6241.18		74	73					pass
															1.02230	

Post-Test Liter Meter Calibration

Method	EPA M-5 #7.2	Date	12/12/13		
Location	Horizon Shop	Pb=	30.2	(in Hg)	
Meter Box ID	LBM4	Ta=	50	(°F)	
Meter ID	2835271	Tamb	509.67	(°R)	
calibrated by	JS, PT	Y=	1.0223	Standard Meter	
		Leak check Rate	0	in/min @ 25	inches H_20

POST		
6mo.	New	Change
7/24/13	12/12/13	(+/-)
1.02230	1.02951	0.7%

		FIELD METER						STANDARD METER						Time		Allowable
	Meter Pressure H20"	Meter (liters)	Net (liters)	Tdi (°F)	Tdo (°F)	To (°R)	Tm (°R)	Meter (liters)	Net (liters)	Tdi (°F)	Tdo (°F)	To (°R)	Tm (°R)	t (min)	Y	Y 0.02
Initial	1.8	7784.02	18.06	54	55	514.67	514.67	7645.91	18.37	55	55	515.17	515.17	10.0	1.03431	0.0048
Final		7802.08		56	55			7664.28		56	56					pass
Initial	1.8	7802.08	29.30	56	55	516.17	517.17	7664.28	29.52	56	56	515.17	515.17	10.0	1.02946	0.0000
Final		7831.38		61	58			7693.8		55	55					pass
Initial	1.8	7831.38	24.37	61	58	519.17	520.17	7693.8	24.30	55	55	515.17	515.17	10.0	1.02477	0.0047
Final		7855.75		62	61			7718.1		56	56					pass
															1.02951	

Secondary Standard

DATE: 7/15/2013 Operator: Joe Ward

Meter No: 16894627				Meter Box ΔH@ 0.0000						Meter Box Yd 1.0013						Barometric Pressure: 29.79		
				Standard Meter Gas Volume (V_s)			Meter Box Gas Volume (V_{dg})			Std. Meter Temperature (t_s)			Meter Box Temperature (t_d)					
Q	P	H	Yds	Initial	Final	Vf	Initial	Final	Vf	Inlet	Outlet	Avg.	Inlet	Outlet	Avg.	Time	Yd	Run #
0.01	-0.50	0.00	1.0000	0.0	.500	.500	.000	.505	.505	77.0	77.0	77.0	79.0	79.0	79.0	33.70	0.9950	1
0.02	-0.50	0.00	1.0000	0.0	.500	.500	0.000	.504	.504	77.0	77.0	77.0	79.0	79.0	79.0	32.55	0.9970	1
0.01	-0.50	0.00	1.0000	0.0	.500	.500	.000	.504	.504	77.0	77.0	77.0	79.0	79.0	79.0	32.65	0.9970	1
0.03	-0.50	0.00	1.0000	0.0	1.000	1.000	.000	.999	.999	77.0	77.0	77.0	79.0	79.0	79.0	29.48	1.0059	2
0.03	-0.50	0.00	1.0000	0.0	1.000	1.000	.000	1.000	1.000	77.0	77.0	77.0	79.0	79.0	79.0	29.14	1.0050	2
0.03	-0.50	0.00	1.0000	0.0	1.000	1.000	.000	1.000	1.000	77.0	77.0	77.0	79.0	79.0	79.0	29.35	1.0050	2
0.05	-0.50	0.00	1.0000	0.0	1.000	1.000	.000	1.000	1.000	77.0	77.0	77.0	79.0	79.0	79.0	17.95	1.0050	3
0.05	-0.50	0.00	1.0000	0.0	1.000	1.000	.000	1.000	1.000	77.0	77.0	77.0	79.0	79.0	79.0	17.83	1.0050	3
0.05	-0.50	0.00	1.0000	0.0	1.000	1.000	.000	1.000	1.000	77.0	77.0	77.0	79.0	79.0	79.0	17.81	1.0050	3
0.07	-0.50	0.00	1.0000	0.0	1.000	1.000	.000	.990	.990	77.0	77.0	77.0	79.0	79.0	79.0	13.70	1.0156	4
0.07	-0.50	0.00	1.0000	0.0	1.000	1.000	.000	.990	.990	77.0	77.0	77.0	79.0	79.0	79.0	13.62	1.0156	4
0.07	-0.50	0.00	1.0000	0.0	1.000	1.000	.000	.990	.990	77.0	77.0	77.0	79.0	79.0	79.0	13.47	1.0152	4
0.10	-0.50	0.00	1.0000	0.0	1.000	1.000	.000	.997	.997	77.0	77.0	77.0	79.0	79.0	79.0	9.65	1.0077	5
0.10	-0.50	0.00	1.0000	0.0	1.000	1.000	.000	.997	.997	77.0	77.0	77.0	79.0	79.0	79.0	9.71	1.0076	5
0.10	-0.50	0.00	1.0000	0.0	1.000	1.000	.000	.998	.998	77.0	77.0	77.0	79.0	79.0	79.0	9.74	1.0075	5
																AVERAGE	1.0059	

Operator Signature ________

Millennium Instruments Inc.
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E-mail: millennium@millinst.com
www.millinst.com

Pitot Calibrations

Method: #2 sec 4 WT Location: Whitaker Shop

Pitot	Date Tested	Cp	S	Pitot	Date Tested	Cp	S	Pitot	Date Tested	Cp	S	Pitot	Date Tested	Cp	S
6s-1	8/2/2013	0.8406	0.005	6s-13	8/9/2013	0.8496	0.003					03070-10	10/15/2012	#DIV/0!	#DIV/0!
6s-2	8/13/2013	0.8408	0.003	6s-14	8/15/2013	0.8328	0.008	8s-2	8/14/2013	0.8291	0.006	T-4-1	1/0/1900	#DIV/0!	#DIV/0!
6s-3	8/13/2013	0.8376	0.006	7s-1	8/13/2013	0.8254	0.002	8s-3	8/14/2013	0.8247	0.005	P3-D6	11/22/2011	#DIV/0!	#DIV/0!
6s-4	1/0/1900	#DIV/0!	#DIV/0!	7s-2	1/0/1900	#DIV/0!	#DIV/0!	9s-1	8/13/2013	0.8271	0.007	P4-B9	8/27/2013	0.8218	0.001
6s-5	1/0/1900	#DIV/0!	#DIV/0!	894-5	8/28/2013	0.8034	0.001	9s-2	8/15/2013	0.8322	0.004	P10652	8/27/2013	0.8137	0.001
6s-6	8/13/2013	0.8410	0.006					10s-1	8/14/2013	0.8144	0.001	P10662	8/27/2013	0.8220	0.000
6s-7	1/0/1900	#DIV/0!	#DIV/0!					11s-1	8/14/2013	0.8169	0.003				
6s-8	8/2/2013	0.8221	0.007					14s-2	12/19/2014	0.8341	0.008				
6s-9	8/13/2013	0.8305	0.006					SR-18	2/27/2013	#DIV/0!	#DIV/0!				
6s-10	1/0/1900	#DIV/0!	#DIV/0!					SR-36	2/27/2013	#DIV/0!	#DIV/0!				
6s-11	8/27/2013	0.8202	0.004					SR-48	10/24/2013	0.8338	0.001				
6s-12	8/12/2013	0.8187	0.008					SR-48A	8/28/2013	0.8121	0.001				

		DpP (P-Type)	DpS (S-Type)	Cp	dS	Ave Cp	S <0.01
	6s-1	0.340	0.480	0.8332	0.0074	0.8406	0.005
Status	Pass	0.550	0.760	0.8422	0.0016	Cp Limits	Pass
Date	8/2/2013	0.950	1.300	0.8463	0.0057	MAX/MIN	Pass
Tester	MV					S Limits	Pass
	6s-2	0.320	0.440	0.8443	0.0035	0.8408	0.003
Status	Pass	0.585	0.810	0.8413	0.0006	Cp Limits	Pass
Date	8/13/2013	1.000	1.400	0.8367	0.0041	MAX/MIN	Pass
Tester	JM					S Limits	Pass
	6s-3	0.280	0.390	0.8388	0.0012	0.8376	0.006
Status	Pass	0.540	0.740	0.8457	0.0081	Cp Limits	Pass
Date	8/13/2013	0.910	1.300	0.8283	0.0093	MAX/MIN	Pass
Tester	JM					S Limits	Pass
	6s-4			#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Status	#DIV/0!			#DIV/0!	#DIV/0!	Cp Limits	#DIV/0!
Date				#DIV/0!	#DIV/0!	MAX/MIN	#DIV/0!
Tester						S Limits	#DIV/0!
	6s-5			#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Status	#DIV/0!			#DIV/0!	#DIV/0!	Cp Limits	#DIV/0!
Date				#DIV/0!	#DIV/0!	MAX/MIN	#DIV/0!
Tester						S Limits	#DIV/0!
	6s-6	0.315	0.430	0.8473	0.006	0.8410	0.006
Status	Pass	0.595	0.820	0.8433	0.002	Cp Limits	Pass
Date	8/13/2013	1.025	1.450	0.8324	0.009	MAX/MIN	Pass
Tester	JM					S Limits	Pass
	6s-7			#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Status	#DIV/0!			#DIV/0!	#DIV/0!	Cp Limits	#DIV/0!
Date				#DIV/0!	#DIV/0!	MAX/MIN	#DIV/0!
Tester						S Limits	#DIV/0!
	6s-8	0.300	0.440	0.8175	0.005	0.8221	0.007
Status	Pass	0.530	0.780	0.8161	0.006	Cp Limits	Pass
Date	8/2/2013	0.920	1.300	0.8328	0.011	MAX/MIN	Pass
Tester	MV					S Limits	Pass
	6s-9	0.300	0.425	0.8318	0.001	0.8305	0.006
Status	Pass	0.560	0.780	0.8388	0.008	Cp Limits	Pass
Date	8/13/2013	0.980	1.425	0.8210	0.010	MAX/MIN	Pass
Tester	JM					S Limits	Pass
	6s-10			#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Status	#DIV/0!			#DIV/0!	#DIV/0!	Cp Limits	#DIV/0!
Date				#DIV/0!	#DIV/0!	MAX/MIN	#DIV/0!
Tester						S Limits	#DIV/0!
	6s-11	0.320	0.460	0.8257	0.006	0.8202	0.004
Status	Pass	0.640	0.940	0.8169	0.003	Cp Limits	Pass
Date	8/27/2013	0.990	1.450	0.8180	0.002	MAX/MIN	Pass
Tester	pt					S Limits	Pass
	6s-12	0.310	0.440	0.8310	0.012	0.8187	0.008
Status	Pass	0.560	0.830	0.8132	0.005	Cp Limits	Pass
Date	8/12/2013	0.975	1.450	0.8118	0.007	MAX/MIN	Pass
Tester	JM					S Limits	Pass
	6s-13	0.290	0.390	0.8537	0.004	0.8496	0.003
Status	Pass	0.555	0.755	0.8488	0.001	Cp Limits	Pass
Date	8/9/2013	0.950	1.300	0.8463	0.003	MAX/MIN	Pass
Tester	JM					S Limits	Pass
	6s-14	0.330	0.460	0.8385	0.006	0.8328	0.008
Status	Pass	0.590	0.820	0.8398	0.007	Cp Limits	Pass
Date	8/15/2013	0.995	1.450	0.8201	0.013	MAX/MIN	Pass
Tester	JM					S Limits	Pass
	7s-1	0.290	0.420	0.8226	0.003	0.8254	0.002
Status	Pass	0.545	0.780	0.8275	0.002	Cp Limits	Pass
Date	8/13/2013	0.940	1.350	0.8261	0.001	MAX/MIN	Pass
Tester	JM					S Limits	Pass
	7s-2			#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Status	#DIV/0!			#DIV/0!	#DIV/0!	Cp Limits	#DIV/0!
Date				#DIV/0!	#DIV/0!	MAX/MIN	#DIV/0!
Tester						S Limits	#DIV/0!
	894-5	0.310	0.470	0.8040	0.001	0.8034	0.001
Status	Pass	0.610	0.930	0.8018	0.002	Cp Limits	Pass
Date	8/28/2013	0.990	1.500	0.8043	0.001	MAX/MIN	Pass
Tester	pt					S Limits	Pass

		DpP (P-Type)	DpS (S-Type)	Cp	dS	Ave Cp	S <0.01
	xx-xx			#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Status	#DIV/0!			#DIV/0!	#DIV/0!	Cp Limits	#DIV/0!
Date				#DIV/0!	#DIV/0!	MAX/MIN	#DIV/0!
Tester						S Limits	#DIV/0!
	8s-2	0.315	0.440	0.8377	0.009	0.8291	0.006
Status	Pass	0.580	0.830	0.8276	0.002	Cp Limits	Pass
Date	8/14/2013	1.000	1.450	0.8222	0.007	MAX/MIN	Pass
Tester	JM					S Limits	Pass
	8s-3	0.320	0.470	0.8169	0.008	0.8247	0.005
Status	Pass	0.610	0.870	0.8290	0.004	Cp Limits	Pass
Date	8/14/2013	1.050	1.500	0.8283	0.004	MAX/MIN	Pass
Tester	JM					S Limits	Pass
	9s-1	0.320	0.460	0.8257	0.001	0.8271	0.007
Status	Pass	0.615	0.860	0.8372	0.010	Cp Limits	Pass
Date	8/13/2013	1.025	1.500	0.8184	0.009	MAX/MIN	Pass
Tester	JM					S Limits	Pass
	9s-2	0.315	0.450	0.8283	0.004	0.8322	0.004
Status	Pass	0.605	0.860	0.8304	0.002	Cp Limits	Pass
Date	8/15/2013	1.075	1.500	0.8381	0.006	MAX/MIN	Pass
Tester	JM					S Limits	Pass
	10s-1	0.310	0.460	0.8127	0.002	0.8144	0.001
Status	Pass	0.590	0.870	0.8153	0.001	Cp Limits	Pass
Date	8/14/2013	1.000	1.475	0.8152	0.001	MAX/MIN	Pass
Tester	JM					S Limits	Pass
	11s-1	0.310	0.460	0.8127	0.004	0.8169	0.003
Status	Pass	0.610	0.890	0.8196	0.003	Cp Limits	Pass
Date	8/14/2013	1.025	1.500	0.8184	0.001	MAX/MIN	Pass
Tester	JM					S Limits	Pass
	14s-2	0.335	0.485	0.8228	0.011	0.8341	0.008
Status	Pass	0.640	0.895	0.8372	0.003	Cp Limits	Pass
Date	12/19/2014	1.050	1.450	0.8425	0.008	MAX/MIN	Pass
Tester	JS					S Limits	Pass
	SR-18			#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Status	#DIV/0!			#DIV/0!	#DIV/0!	Cp Limits	#DIV/0!
Date	2/27/2013			#DIV/0!	#DIV/0!	MAX/MIN	#DIV/0!
Tester	jm					S Limits	#DIV/0!
	SR-36			#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Status	#DIV/0!			#DIV/0!	#DIV/0!	Cp Limits	#DIV/0!
Date	2/27/2013			#DIV/0!	#DIV/0!	MAX/MIN	#DIV/0!
Tester	jm					S Limits	#DIV/0!
	SR-48	0.320	0.450	0.8348	0.001	0.8338	0.001
Status	Pass	0.600	0.850	0.8318	0.002	Cp Limits	Pass
Date	10/24/2013	0.960	1.350	0.8348	0.001	MAX/MIN	Pass
Tester	pt					S Limits	Pass
	SR-48A	0.330	0.490	0.8124	0.000	0.8121	0.001
Status	Pass	0.600	0.890	0.8129	0.001	Cp Limits	Pass
Date	8/28/2013	0.990	1.475	0.8111	0.001	MAX/MIN	Pass
Tester	pt					S Limits	Pass
	03070-10			#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Status	#DIV/0!			#DIV/0!	#DIV/0!	Cp Limits	#DIV/0!
Date	10/15/2012			#DIV/0!	#DIV/0!	MAX/MIN	#DIV/0!
Tester	jm					S Limits	#DIV/0!
	T-4-1			#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Status	#DIV/0!			#DIV/0!	#DIV/0!	Cp Limits	#DIV/0!
Date				#DIV/0!	#DIV/0!	MAX/MIN	#DIV/0!
Tester						S Limits	#DIV/0!
	P3-D6			#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Status	#DIV/0!			#DIV/0!	#DIV/0!	Cp Limits	#DIV/0!
Date	11/22/2011			#DIV/0!	#DIV/0!	MAX/MIN	#DIV/0!
Tester	PT					S Limits	#DIV/0!
	P4-B9	0.330	0.480	0.8209	0.001	0.8218	0.001
Status	Pass	0.620	0.900	0.8217	0.000	Cp Limits	Pass
Date	8/27/2013	0.950	1.375	0.8229	0.001	MAX/MIN	Pass
Tester	PT					S Limits	Pass
	P10652	0.290	0.430	0.8130	0.001	0.8137	0.001
Status	Pass	0.570	0.840	0.8155	0.002	Cp Limits	Pass
Date	8/27/2013	0.960	1.425	0.8126	0.001	MAX/MIN	Pass
Tester	PT					S Limits	Pass

Date:	27-Nov-13		Location	Horizon Shop			Standard
Tester(s):	jy,dd						537/MB14
QA/QC	MEW						
Pt. 60, App. A, Method 2, 6.2 (Differential Pressure Gauges)							
Magnehelic ID	15 sec. High	leak check Low	Scale Inches	Shortridge in H2O	Manometer in H2O	Difference in H2O	Difference %
SR#1			electronic	0	0	< Set to Zero	
Date	12/12/2013			0.0720	0.0700	0.0020	2.9%
Personnel	DD			0.5050	0.5000	0.0050	1.0%
Status	PASS			1.0070	1.0000	0.0070	0.7%
				2.0310	2.0000	0.0310	1.6%
SR#2			electronic	0	0	< Set to Zero	
Date	12/12/2013			0.0514	0.0500	0.0014	2.8%
Personnel	DD			0.5101	0.5000	0.0101	2.0%
Status	PASS			1.0250	1.0000	0.0250	2.5%
				2.0510	2.0000	0.0510	2.6%
SR#3			electronic	0.0000	0.0000	< Set to Zero	
Date	1/6/2014			0.0512	0.0500	0.0012	2.4%
Personnel	JS			0.5106	0.5000	0.0106	2.1%
Status	PASS			1.0210	1.0000	0.0210	2.1%
				2.0180	2.0000	0.0180	0.9%
SR # 4	TV-2		electronic	0	0	< Set to Zero	
Date	11/27/2013			0.0950	0.10	-0.0050	5.0%
Personnel	jy			0.5090	0.50	0.0090	1.8%
Status	PASS			1.0250	1.00	0.0250	2.5%
				2.0250	2.00	0.0250	1.3%
SR#5			electronic	0	0	< Set to Zero	
Date						0.0000	#DIV/0!
Personnel						0.0000	#DIV/0!
Status	#DIV/0!					0.0000	#DIV/0!
						0.0000	#DIV/0!
SR # 6			electronic	0	0	< Set to Zero	
Date	1/2/2014			0.5500	0.56	-0.0050	0.9%
Personnel	CS			3.3100	3.30	0.0100	0.3%
Status	PASS			5.5080	5.50	0.0080	0.1%
				7.0850	7.10	-0.0150	0.2%
SR#7			electronic	0	0	< Set to Zero	
Date	11/27/2013			0.0506	0.05	0.0000	0.0%
Personnel	JY			0.5165	0.50	0.0165	3.3%
Status	PASS			1.0250	1.00	0.0250	2.5%
				2.0350	2.00	0.0350	1.8%

Calibration complies with ISO/IEC 17025, ANSI/NCSL Z540-1, and 9001

ilac-MRA ACCREDITED

Calibration Certificate No. 1750.01

Cert. No.: 4039-5203392

Traceable® Certificate of Calibration for Water-Proof Thermometer °F/°C

Cust ID:Horizon Engineering, 13585 NE Whitaker Way, Attn. Joe Heffernan III, Portland, OR 97230 U.S.A. (RMA:978813)

Instrument Identification:

TL

Model: 90205-22 S/N: 111661402 Manufacturer: Control Company

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Temperature Calibration Bath TC-179	A45240		
Thermistor Module	A17118	2/13/14	1000332071
Temperature Probe	128	2/20/14	6-B48Z9-30-1
Temperature Calibration Bath TC-218	A73332		
Thermistor Module	A27129	11/09/13	1000327261
Temperature Probe	5202	11/30/14	15-B15PW-1-1

Certificate Information: **Amended Ref: 4039-5182675**

Technician: 68 Procedure: CAL-03 Cal Date: 6/24/13 **Cal Due: 6/24/15**

Test Conditions: 24.5°C 42.0 %RH 1016 mBar

Calibration Data:

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
°C		N.A.		0.000	-0.1	Y	-1.0	1.0	0.059	>4:1
°C		N.A.		100.000	100.0	Y	99.0	101.0	0.059	>4:1

This Instrument was calibrated using Instruments Traceable to National Institute of Standards and Technology.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

Nominal=Standard's Reading; As Left=Instrument's Reading; In Tol=In Tolerance; Min/Max=Acceptance Range; ±U=Expanded Measurement Uncertainty; TUR=Test Uncertainty Ratio; Accuracy=±(Max-Min)/2; Min = As Left Nominal(Rounded) - Tolerance; Max = As Left Nominal(Rounded) + Tolerance; Date=MM/DD/YY

Aaron Judice, Technical Manager

Maintaining Accuracy:

In our opinion once calibrated your Water-Proof Thermometer °F/°C should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Water-Proof Thermometer °F/°Cs change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

CONTROL COMPANY 4455 Rex Road Friendswood, TX 77546 USA
Phone 281 482-1714 Fax 281 482-9448 service@control3.com www.control3.com

Control Company is an ISO 17025:2005 Calibration Laboratory Accredited by (A2LA) American Association for Laboratory Accreditation, Certificate No. 1750.01.
Control Company is ISO 9001:2008 Quality Certified by (DNV) Det Norske Veritas, Certificate No. CERT-01805-2006-AQ-HOU-RvA.
International Laboratory Accreditation Cooperation (ILAC) - Multilateral Recognition Arrangement (MRA).

Calibration
Certificate No. 1750.01

Calibration complies with ISO/IEC 17025, ANSI/NCSL Z540-1, and 9001

Cert. No.: 4039-5203387

Traceable® Certificate of Calibration for Water-Proof Thermometer °F/°C

Cust ID:Horizon Engineering, 13585 NE Whitaker Way, Attn:Joseph Heffernan, Portland, OR 97203 U.S.A. (RMA:978342)

Instrument Identification:

KRK

Model: 90205-22 S/N: 111661406 Manufacturer: Control Company

Standards/Equipment:

Description	Serial Number	Due Date	NIST Traceable Reference
Temperature Calibration Bath TC-179	A45240		
Thermistor Module	A17118	2/13/14	1000332071
Temperature Probe	128	2/20/14	6-B48Z9-30-1
Temperature Calibration Bath TC-218	A73332		
Thermistor Module	A27129	11/09/13	1000327261
Temperature Probe	5202	11/30/14	15-B15PW-1-1

Certificate Information: Amended Ref: 4039-5132597

Technician: 104 Procedure: CAL-03 Cal Date: 6/06/13 **Cal Due: 6/06/15**

Test Conditions: 22.0°C 45.0 %RH 1011 mBar

Calibration Data:

Unit(s)	Nominal	As Found	In Tol	Nominal	As Left	In Tol	Min	Max	±U	TUR
°C		N.A.		0.000	0.0	Y	-1.0	1.0	0.059	>4:1
°C		N.A.		100.000	100.1	Y	99.0	101.0	0.059	>4:1

This Instrument was calibrated using Instruments Traceable to National Institute of Standards and Technology.

A Test Uncertainty Ratio of at least 4:1 is maintained unless otherwise stated and is calculated using the expanded measurement uncertainty. Uncertainty evaluation includes the instrument under test and is calculated in accordance with the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM). The uncertainty represents an expanded uncertainty using a coverage factor k=2 to approximate a 95% confidence level. In tolerance conditions are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. The results contained herein relate only to the item calibrated. This certificate shall not be reproduced except in full, without written approval of Control Company.

Nominal=Standard's Reading; As Left=Instrument's Reading; In Tol=In Tolerance; Min/Max=Acceptance Range; ±U=Expanded Measurement Uncertainty; TUR=Test Uncertainty Ratio; Accuracy=±(Max-Min)/2; Min = As Left Nominal(Rounded) - Tolerance; Max = As Left Nominal(Rounded) + Tolerance; Date=MM/DD/YY

Aaron Judice, Technical Manager

Maintaining Accuracy:

In our opinion once calibrated your Water-Proof Thermometer °F/°C should maintain its accuracy. There is no exact way to determine how long calibration will be maintained. Water-Proof Thermometer °F/°Cs change little, if any at all, but can be affected by aging, temperature, shock, and contamination.

Recalibration:

For factory calibration and re-certification traceable to National Institute of Standards and Technology contact Control Company.

CONTROL COMPANY 4455 Rex Road Friendswood, TX 77546 USA
Phone 281 482-1714 Fax 281 482-9448 service@control3.com www.control3.com

Liter Meter Box Thermocouple Indicator Calibrations

Month: JULY		Testers:	PT	Location: Horizon Shop									
Thermocouple		Ambient				220 +/-				400 +/-			
Indicator	Channel	Standard, °F	Measured, °C	Measured, °F	Difference %	Standard, °F	Measured, °C	Measured, °F	Difference %	Standard, °F	Measured, °C	Measured, °F	Difference %
Liter Meter LMB 1	Probe	75		80	-0.94%	225		230	-0.73%	425		430	-0.57%
22-Jul-13	Filter	75		78	-0.56%	225		227	-0.29%	425		426	-0.11%
Qa/Qc-MEW	Aux 1	75		76	-0.19%	225		228	-0.44%	425		427	-0.23%
	Aux 2	75		76	-0.19%	225		228	-0.44%	425		426	-0.11%
	Meter In	75		77	-0.37%	225		227	-0.29%	425		426	-0.11%
	Meter Out	75		77	-0.37%	225		228	-0.44%	425		427	-0.23%
Liter Meter LMB 2	Probe	75		80	-0.94%	225		230	-0.73%	425		430	-0.57%
22-Jul-13	Filter	75		80	-0.94%	225		229	-0.58%	425		428	-0.34%
Qa/Qc-MEW	Aux 1	75		77	-0.37%	225		228	-0.44%	425		428	-0.34%
	Aux 2	75		78	-0.56%	225		228	-0.44%	425		427	-0.23%
	Meter In	75		77	-0.37%	225		228	-0.44%	425		428	-0.34%
	Meter Out	75		77	-0.37%	225		228	-0.44%	425		427	-0.23%
Liter Meter LMB 3	Probe	75		75	0.00%	225		226	-0.15%	425		426	-0.11%
25-Jul-13	Filter	75		75	0.00%	225		226	-0.15%	425		425	0.00%
Qa/Qc-MEW	Aux 1	75		75	0.00%	225		225	0.00%	425		425	0.00%
	Aux 2	75		75	0.00%	225		225	0.00%	425		425	0.00%
	Aux 3	75		75	0.00%	225		225	0.00%	425		425	0.00%
	Meter Out	75		75	0.00%	225		226	-0.15%	425		425	0.00%
Liter Meter ML4	Probe	75		76	-0.19%	225		227	-0.29%	425		426	-0.11%
24-Jul-13	Oven	75		76	-0.19%	225		224	0.15%	425		423	0.23%
Qa/Qc-MEW	Aux 1	75		78	-0.56%	225		228	-0.44%	425		426	-0.11%
	Aux 2	75		78	-0.56%	225		226	-0.15%	425		425	0.00%
	Meter In	75		77	-0.37%	225		226	-0.15%	425		425	0.00%
	Meter Out	75		77	-0.37%	225		227	-0.29%	425		426	-0.11%

Meterbox Thermocouple Indicator Calibrations

Month: JULY		Testers: PT/MIHAI			Location: Horizon Shop				
Thermocouple		50	Ambient		200	220 +/-			400 +/-	
Indicator	Channel	Standard, F	Measured, F	Difference %	Standard, F	Measured, F	Difference %	Standard, F	Measured, F	Difference %
Meter Box 1	Stack	50	49	0.20%	200	199	0.15%	400	397	0.35%
15-Jul-13	Probe	50	48	0.39%	200	199	0.15%	400	400	0.00%
Qa/Qc-MEW	Oven	50	49	0.20%	200	198	0.30%	400	398	0.23%
	Impinger	50	48	0.39%	200	198	0.30%	400	398	0.23%
	Aux	50	48	0.39%	200	198	0.30%	400	397	0.35%
	Meter In	50	48	0.39%	200	198	0.30%	400	395	0.58%
	Meter Out	50	48	0.39%	200	198	0.30%	400	397	0.35%
Meter Box 2	Stack	50	49	0.20%	200	199	0.15%	400	397	0.35%
2-Jul-13	Probe	50	49	0.20%	200	198	0.30%	400	397	0.35%
Qa/Qc-MEW	Oven	50	52	-0.39%	200	202	-0.30%	400	402	-0.23%
	Impinger	50	48	0.39%	200	199	0.15%	400	399	0.12%
	Aux	50	48	0.39%	200	198	0.30%	400	397	0.35%
	Meter In	50	50	0.00%	200	200	0.00%	400	400	0.00%
	Meter Out	50	50	0.00%	200	200	0.00%	400	400	0.00%
Meter Box 3	Stack	50	48	0.39%	200	197	0.45%	400	398	0.23%
19-Jul-13	Probe	50	49	0.20%	200	197	0.45%	400	399	0.12%
Qa/Qc-MEW	Oven	50	49	0.20%	200	198	0.30%	400	398	0.23%
	Impinger	50	51	-0.20%	200	201	-0.15%	400	400	0.00%
	Aux	50	49	0.20%	200	198	0.30%	400	397	0.35%
	Meter In	50	48	0.39%	200	198	0.30%	400	398	0.23%
	Meter Out	50	51	-0.20%	200	201	-0.15%	400	400	0.00%
Meter Box 4	Stack	50	49	0.20%	200	199	0.15%	400	399	0.12%
14-Nov-13	Probe	50	49	0.20%	200	199	0.15%	400	399	0.12%
Qa/Qc-MEW	Oven	50	49	0.20%	200	199	0.15%	400	399	0.12%
	Impinger	50	49	0.20%	200	199	0.15%	400	399	0.12%
	Aux									
	Meter In	50	49	0.20%	200	199	0.15%	400	398	0.23%
	Meter Out	50	48	0.39%	200	198	0.30%	400	399	0.12%
Meter Box 5	Stack	50	50	0.00%	200	201	-0.15%	400	401	-0.12%
10-Jul-13	Probe	50	49	0.20%	200	201	-0.15%	400	400	0.00%
Qa/Qc-MEW	Oven	50	50	0.00%	200	200	0.00%	400	400	0.00%
	Impinger	50	51	-0.20%	200	200	0.00%	400	401	-0.12%
	Aux	50	50	0.00%	200	201	-0.15%	400	400	0.00%
	Meter In	50	50	0.00%	200	200	0.00%	400	400	0.00%
	Meter Out	50	50	0.00%	200	200	0.00%	400	401	-0.12%
Meter Box 6	Stack	50	50	0.00%	200	200	0.00%	400	400	0.00%
2-Jul-13	Probe	50	51	-0.20%	200	201	-0.15%	400	400	0.00%
Qa/Qc-MEW	Oven	50	50	0.00%	200	200	0.00%	400	400	0.00%
	Impinger	50	50	0.00%	200	200	0.00%	400	400	0.00%
	Meter In	50	50	0.00%	200	200	0.00%	400	400	0.00%
	Meter Out	50	50	0.00%	200	200	0.00%	400	400	0.00%
Meter Box 7	Stack	75	76	-0.19%	225	226	-0.15%	425	426	-0.11%
16-Jul-13	Probe	75	76	-0.19%	225	226	-0.15%	425	426	-0.11%
Qa/Qc-MEW	Oven	75	75	0.00%	225	226	-0.15%	425	426	-0.11%
	Impinger	75	75	0.00%	225	226	-0.15%	425	426	-0.11%
	Aux	75	75	0.00%	225	226	-0.15%	425	425	0.00%
	Meter In	75	75	0.00%	225	226	-0.15%	425	426	-0.11%
	Meter Out	75	76	-0.19%	225	226	-0.15%	425	425	0.00%
Meter Box 8	Stack	75	77	-0.37%	225	227	-0.29%	425	426	-0.11%
16-Jul-13	Probe	75	77	-0.37%	225	227	-0.29%	425	426	-0.11%
Qa/Qc-MEW	Oven	75	77	-0.37%	225	227	-0.29%	425	425	0.00%
	Impinger	75	75	0.00%	225	225	0.00%	425	425	0.00%
	Aux	75	75	0.00%	225	226	-0.15%	425	426	-0.11%
	Meter In	75	75	0.00%	225	226	-0.15%	425	427	-0.23%
	Meter Out	75	76	-0.19%	225	226	-0.15%	425	426	-0.11%
Meter Box 9	Stack	50	48	0.39%	200	198	0.30%	400	397	0.35%
15-Jul-13	Probe	50	47	0.59%	200	198	0.30%	400	397	0.35%
Qa/Qc-MEW	Oven	50	47	0.59%	200	198	0.30%	400	397	0.35%
	Impinger	50	47	0.59%	200	198	0.30%	400	397	0.35%
	Aux	50	48	0.39%	200	198	0.30%	400	396	0.47%
	Meter In	50	48	0.39%	200	200	0.00%	400	397	0.35%
	Meter Out	50	48	0.39%	200	199	0.15%	400	398	0.23%
Meter Box 10	Stack			0.00%			0.00%			0.00%
15-Jul-13	Probe			0.00%			0.00%			0.00%
Qa/Qc-MEW	Oven			0.00%			0.00%			0.00%
	Impinger			0.00%			0.00%			0.00%
	Aux			0.00%			0.00%			0.00%
	Meter In			0.00%			0.00%			0.00%
	Meter Out			0.00%			0.00%			0.00%
Meter Box 11	Stack			0.00%			0.00%			0.00%
7-Feb-13	Probe			0.00%			0.00%			0.00%
Qa/Qc-MEW	Oven			0.00%			0.00%			0.00%
	Impinger			0.00%			0.00%			0.00%

Meterbox Thermocouple Indicator Calibrations

	Aux			0.00%			0.00%			0.00%
	Meter In			0.00%			0.00%			0.00%
	Meter Out			0.00%			0.00%			0.00%
Month:		Testers:			Location: Horizon Shop					
Thermocouple		Ambient			220 +/-			400 +/-		
Indicator	Channel	Standard, F	Measured, F	Difference %	Standard, F	Measured, F	Difference %	Standard, F	Measured, F	Difference %
Meter Box 13	Stack	50	51	-0.20%	200	202	-0.30%	400	400	0.00%
2-Jul-13	Probe	50	51	-0.20%	200	200	0.00%	400	399	0.12%
Qa/Qc-MEW	Oven	50	51	-0.20%	200	201	-0.15%	400	398	0.23%
	Impinger	50	51	-0.20%	200	200	0.00%	400	400	0.00%
	Aux	50	51	-0.20%	200	200	0.00%	400	399	0.12%
	Meter In	50	51	-0.20%	200	200	0.00%	400	399	0.12%
	Meter Out	50	51	-0.20%	200	200	0.00%	400	400	0.00%
Meter Box 14	Stack			0.00%			0.00%			0.00%
15-Jul-13	Probe			0.00%			0.00%			0.00%
Qa/Qc-MEW	Oven			0.00%			0.00%			0.00%
	Impinger			0.00%			0.00%			0.00%
	Aux									
	Meter In			0.00%			0.00%			0.00%
	Meter Out			0.00%			0.00%			0.00%
Meter Box 15	Stack	73	73	0.00%	200	200	0.00%	400	397	0.35%
15-Jul-13	Probe	73	73	0.00%	200	203	-0.45%	400	399	0.12%
Qa/Qc-MEW	Oven	73	74	-0.19%	200	203	-0.45%	400	399	0.12%
	Impinger	73	74	-0.19%	200	200	0.00%	400	397	0.35%
	Aux	73	73	0.00%	200	200	0.00%	400	397	0.35%
	Meter In	73	74	-0.19%	200	198	0.30%	400	393	0.81%
	Meter Out	73	74	-0.19%	200	199	0.15%	400	395	0.58%
Meter Box 16	Stack	50	50	0.00%	200	201	-0.15%	400	400	0.00%
2-Jul-13	Probe	50	50	0.00%	200	202	-0.30%	400	400	0.00%
Qa/Qc-MEW	Oven	50	50	0.00%	200	201	-0.15%	400	401	-0.12%
	Impinger	50	49	0.20%	200	201	-0.15%	400	399	0.12%
	Aux	50	49	0.20%	200	200	0.00%	400	399	0.12%
	Meter In	50	50	0.00%	200	201	-0.15%	400	399	0.12%
	Meter Out	50	48	0.39%	200	201	-0.15%	400	400	0.00%
Meter Box 17	Stack	75	76	-0.19%	225	227	-0.29%	425	425	0.00%
19-Jul-13	Probe	75	76	-0.19%	225	228	-0.44%	425	425	0.00%
Qa/Qc-MEW	Oven	75	76	-0.19%	225	227	-0.29%	425	425	0.00%
	Impinger	75	74	0.19%	225	226	-0.15%	425	423	0.23%
	Aux	75	75	0.00%	225	226	-0.15%	425	424	0.11%
	Meter In	75	76	-0.19%	225	228	-0.44%	425	425	0.00%
	Meter Out	75	75	0.00%	225	228	-0.44%	425	426	-0.11%
Meter Box 18	Stack	75	77	-0.37%	225	229	-0.58%	425	427	-0.23%
16-Jul-13	Probe	75	77	-0.37%	225	228	-0.44%	425	427	-0.23%
Qa/Qc-MEW	Oven	75	77	-0.37%	225	228	-0.44%	425	427	-0.23%
	Impinger	75	77	-0.37%	225	228	-0.44%	425	427	-0.23%
	Aux	75	77	-0.37%	225	228	-0.44%	425	427	-0.23%
	Meter In	75	76	-0.19%	225	227	-0.29%	425	427	-0.23%
	Meter Out	75	76	-0.19%	225	227	-0.29%	425	427	-0.23%
Meter Box 19	Stack	75	75	0.00%	200	202	-0.30%	400	401	-0.12%
17-Sep-13	Probe	75	74	0.19%	200	201	-0.15%	400	402	-0.23%
Qa/Qc-MEW	Oven	75	75	0.00%	200	202	-0.30%	400	402	-0.23%
	Impinger	75	76	-0.19%	200	202	-0.30%	400	401	-0.12%
	Aux	75	76	-0.19%	200	202	-0.30%	400	401	-0.12%
	Meter In	75	75	0.00%	200	201	-0.15%	400	400	0.00%
	Meter Out	75	75	0.00%	200	201	-0.15%	400	400	0.00%
Meter Box 20	Stack	50	48	0.39%	200	200	0.00%	400	398	0.23%
10-Jul-13	Probe	50	49	0.20%	200	200	0.00%	400	398	0.23%
Qa/Qc-MEW	Oven	50	48	0.39%	200	200	0.00%	400	399	0.12%
	Impinger	50	48	0.39%	200	200	0.00%	400	398	0.23%
	Aux	50	48	0.39%	200	200	0.00%	400	398	0.23%
	Filter	50	50	0.00%	200	200	0.00%	400	398	0.23%
	Meter	50	48	0.39%	200	195	0.76%	400	395	0.58%
Meter Box 21	Stack	50	49	0.20%	200	199	0.15%	400	399	0.12%
3-Jul-13	Probe	50	48	0.39%	200	199	0.15%	400	397	0.35%
Qa/Qc-MEW	Oven	50	49	0.20%	200	199	0.15%	400	399	0.12%
	Impinger	50	49	0.20%	200	199	0.15%	400	399	0.12%
	Aux	50	49	0.20%	200	199	0.15%	400	399	0.12%
	Meter	50	48	0.39%	200	199	0.15%	400	398	0.23%
Meter Box 22	Stack	75	77	-0.37%	200	202	-0.30%	400	400	0.00%
17-Sep-13	Probe	75	77	-0.37%	200	202	-0.30%	400	400	0.00%
Qa/Qc-MEW	Oven	75	77	-0.37%	200	202	-0.30%	400	400	0.00%
	Impinger	75	76	-0.19%	200	202	-0.30%	400	400	0.00%
	Aux	75	76	-0.19%	200	202	-0.30%	400	400	0.00%
	Meter In	75	76	-0.19%	200	202	-0.30%	400	400	0.00%
	Meter Out			0.00%			0.00%			0.00%

Branom Instrument Co.
Since 1947
BRANOM INSTRUMENTATION

HE #554

CERTIFICATE OF CALIBRATION # 34279

Customer Name:	Amtest Air Quality	Branom Order #:	9-488139
Address:	PO Box 525 Preston, WA 98050	Certification Date: Re-certification Date:	30-Jul-12 30-Jul-13
PO#:	Cash Sale	Lab Temperature:	73.3°F
Instrument Make:	Altek	Lab Humidity:	43.8%
Model Number:	Series 22	Lab Technician:	Roy Person
Description:	Thermocouple Source	As Found Condition:	In tolerance
Serial Number:	8510116	As Left Condition:	In tolerance

Calibration Standard(s)

Make	Model	Serial Number	Cal Date	Date Due	Description
Fluke	8845A	1026016	10/06/11	10/06/2012	DMM

Branom Instrument Company guarantees that the following instrument meets or exceeds all published specifications and has been calibrated using standards that are traceable to the National Institute of Standards and Technology (NIST). The following certificate applies only to the instrument listed below. This certificate shall not be reproduced, except in full, without written approval by Branom Instrument Company.

Comments: None.

Corey Porter
Q.A. Manager

Grant Edgel Company

MFG. RED COMET OVENS

TELEPHONE 254-6524 (AREA CODE 503)

4233 N.E. 147TH AVENUE P.O. BOX 20116 PORTLAND, OREGON 97220

LABORATORY PRIMARY STANDARDS

CERTIFICATE

FOR

Fluke 52

HE# 000197

GRANT EDGEL PRIMARY STANDARDS LABORATORY EQUIPMENT VALIDATION

ID NO

DATE

NEXT DUE

BY

Submitted By

Horizon Engineering

13585 NE Whittaker Way

Portland, OR 97230

Test	Error	Test	Error
0°F	-1.4	400°F	-1.2
100°F	-1.8	500°F	-1.0
200°F	-1.0	1000°F	-.6
300°F	-,6	2000°F	0.0

Certified By: Fluke Model 724 Serial# 9806098

Resubmission Date: 2-1-13

The accuracy stated on this certificate is traceable to the NATIONAL INSTITUTE OF STANDARDS through certification documents on file in the Metrology Laboratory of the Grant Edgel Company.

Test Conditions

AMBIENT TEMP.: 69°F

REL. HUMIDITY: 54%

DATE: 10-20-12

REPORT NO.: 12J-3

SERVICE ORDER: 21244

P.O. NUMBER:

Authorized Signatures

PERFORMED BY: RG

APPROVED BY: Bob Edgel

RESUBMISSION DATE: 10-20-13

A Satisfied Customer is Our First Consideration

13585 NE Whitaker Way • Portland, OR 97230
Phone (503) 255-5050 • Fax (503) 255-0505
www.horizonengineering.com

December 18, 2012
January 2, 2013
January 4, 2013
Horizon Engineering Shop
Barometer Calibration

National Weather Service (PDX Int'l Airport)	12/18/2012	30.01"Hg
National Weather Service (PDX Int'l Airport)	01/02/2013	30.32"Hg
Auburn Standard	01/04/2013	30.30"Hg
TV 1	12/18/2012	30.10"Hg
TV 2	12/18/2012	30.20"Hg
TV 3	12/18/2012	30.10"Hg
TV 4	12/18/2012	30.10"Hg
TV 5	12/18/2012	30.10"Hg
Carl Slimp's Watch	01/04/2013	30.30"Hg
Shortridge #1 (HE 276)	12/18/2012	30.30"Hg
Shortridge #2 (HE 028)	01/02/2013	30.60"Hg
Shortridge #3 (HE 226)	12/18/2012	30.00"Hg
Shortridge #4 (HE 325)	12/18/2012	30.10"Hg
Shortridge #5 (HE 414)	12/18/2012	29.90"Hg
Shortridge #6	01/04/2013	30.30"Hg
Shortridge #7 (HE 324)	01/02/2013	30.40"Hg
Shortridge #8	12/18/2012	30.10"Hg
Portland Shop Barometer	12/18/2012	30.20"Hg

All pressures are absolute, read at the Horizon Engineering shop.
Joe Heffernan III

Correspondence

Source Test Plan and Correspondence

HORIZON ENGINEERING LLC

13585 NE Whitaker Way • Portland, OR 97230
Phone (503) 255-5050 • Fax (503) 255-0505
www.horizonengineering.com

November 25, 2013 Project No. 4980

Ms. Roylene Cunningham
EPA – Region 10
1200 6th Avenue, Suite 900
OCE – 127
Seattle, Washington 98101

Mr. Zach Hedgpeth, P.E.
EPA – Region 10
1200 6th Avenue, Suite 900
OEA – 095
Seattle, Washington 98101

Re: Clearwater Paper Corporation in Lewiston, Idaho -- Pre-Test feasibility study Pursuant to EPA Request for Information, July 19, 2013

On behalf of Clearwater Paper Corporation (CLW) Horizon Engineering submits this field planning document for a pre-testing feasibility study for the above-referenced facility beginning the week of December 2nd, 2013.

1. **Sources:** Internal process points associated with the M&D No. 1 and M&D No. 2 Digesters

2. **Tentative Pre-Test Study Locations:**[1]
   - Sample Point 1a M&D No. 1: Exhaust to Kone Bin
   - Sample Point 2a M&D No. 1: Exhaust to Kone Bin
   - Sample Point 3a M&D No. 1: Secondary Exhaust from the Rotary Valve to the Exhaust Chamber
   - Sample Point 4a M&D No. 1: Exhaust line from Drop Chute to Exhaust Chamber
   - Sample Point 1b M&D No. 2: Exhaust to Kone Bin
   - Sample Point 2b M&D No. 2: Exhaust to Kone Bin
   - Sample Point 3b M&D No. 2: Secondary Exhaust from the Rotary Valve to the Exhaust Chamber
   - Sample Point 4b M&D No. 2: Exhaust line from Drop Chute to Exhaust Chamber

[1] The feasibility study will focus on the four sample points from one of the M&D Units. It will be assumed that the other M&D Unit sample points will be similar in characteristics.

3. **Purpose of the Study:** To determine if future testing can be done for Compliance with the RFI and extension granted on August 28, 2013.

4. **Process Description:** The sawdust pulping system includes two M&D continuous digesters, each operating at approximately 250 ADT/day of equivalent bleached pulp production. Two sawdust storage silos pneumatically feed sawdust to the top of a cyclone separator, where the wood and transport air are separated. On each line, the wood drops into a storage vessel known as the Kone bin, located below the cyclone. Each Kone bin typically contains 10 to 15 feet of wood during normal operation.

   On each line, sawdust gravity feeds from the Kone bin into a metering screw, which feeds a rotary inlet valve known as the Bauer valve, before dropping into the digester itself. The rotary inlet valve contains 10 pockets. As the pockets rotate they are sealed against the casing of the valve. The seal prevents back-flow from the pressurized digester vessel.

   Fresh steam is used in each rotary inlet valve to heat the sawdust, to pressurize the valve pockets, and to help push sawdust out of the valve pockets to purge the pocket. Sawdust then falls by gravity into the digester vessel. The majority of this steam is either discharged into the digester vessel with the sawdust, or is recycled from the discharge side of the valve to the inlet side of the valve via the primary exhaust line. Secondary exhaust from each rotary inlet valve flows to an exhaust chamber, where it is sprayed with a condensing shower of mill water. Any remaining material not condensed and injected into the sawdust through the metering screw will move through two lines into the bottom of the Kone bin. In addition to the secondary exhaust line, a line from the drop chute between the metering screw and the rotary inlet valve also flows to the exhaust chamber. (See Figure 1)

   Once the wood enters the digester it falls onto a midfeather separating plate, where it is confined between constantly moving flights. The flights carry the sawdust down the top side of the midfeather, around the lower end of the digester, and then up the bottom half of the divided digester. When the sawdust reaches the top of the digester, it exits out of the discharge nozzle (on the bottom side of the digester) and falls into the surge tube, before going on to the blow tank. From the blow tank the sawdust pulp is washed and screened, prior to a final bleaching operation.

   Figure 1 shows the process along with identification of the installed sampling points.

Roylene Cunningham & Zach Hedgpeth, EPA Region 10, November 25, 2013
3

M&D Sample Points

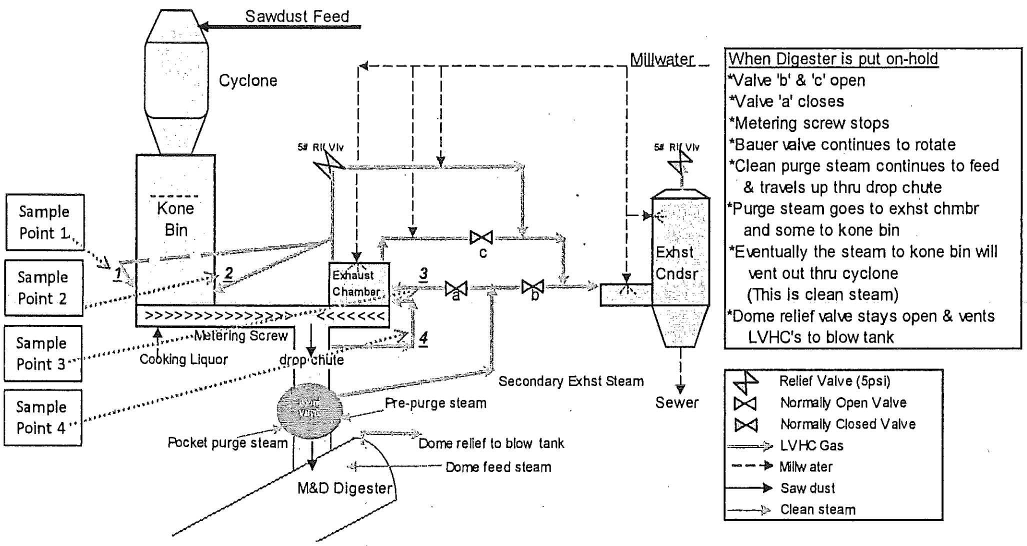

Figure 1 - Process and Sample Point Diagram

Note: The above diagram reflects M&D No.1 installed sample points 1a, 2a, 3a, & 4a. Installed sample points 1b, 2b, 3b, & 4b for M&D No.2 are located in the same relative position.

5. **Process Mode of Operation During Study**: The operating mode during the feasibility study will be at normal operating rates and conditions. The pulp from these digesters will be processed through a 4-stage brownstock washing line, and then through a 4-stage bleach plant. The pulp will be used in the manufacture of bleached paperboard.

Roylene Cunningham & Zach Hedgpeth, EPA Region 10, November 25, 2013
4

6. **Constituents proposed to be Tested per the ICR request:** Methanol and TRS.[2]

7. **Test Methods Proposed in original test plan:** The field pre-test evaluation is to be conducted to determine the suitability of testing according to the following methods:

   Sample Points 1a and 2a (M&D No.1) and 1b and 2b (M&D No.2):

Flow Rate:	EPA Methods 1A and Modified 2C (S- pitot flow traverses of duct <12")[3]
CO_2 and O_2:	Assume ambient molecular weight 28.96
Moisture:	EPA Method ALT-008 (midget impinger catch incorporated with EPA Method 308)
Methanol:	EPA Method 308 (sorbent tube and midget impinger with analysis by GC/FID)
TRS:	ASTM D5504-08 (silonite coated Summa canister with analysis by GC/SCD)

   Sample Points 3a and 4a (M&D No.1) and 3b and 4b (M&D No.2):

Flow Rate:	EPA Methods 1A and 2D (calibrated orifice plates)
CO_2 and O_2:	Assume ambient molecular weight 28.96
Moisture:	EPA Method ALT-008 (midget impinger catch incorporated with EPA Method 308)
Methanol:	EPA Method 308 (sorbent tube and midget impinger with analysis by GC/FID)

8. **Pre-test actions:** Work will be done and observations will be recorded at each of the four locations on one of the M&D systems. We are very interested to determine if there is any dry gas at the sample locations and to determine how much the presence of sawdust will affect sampling. During the field study, method modifications may be attempted to collect a sample and flow. Any modifications will be documented. At a minimum we plan to attempt to gather or assess the following information:

   - Dry bulb temperatures
   - Wet bulb temperatures
   - Static pressures
   - Ability to collect Summa canisters in a conventional or non-conventional way for ASTM D5504-08 analysis
   - Ability to collect EPA Method 308 samples in a conventional or non-conventional way
   - Ability to do EPA flow rates and what modifications may be necessary for future measurements.

   Detailed notes will be recorded and photos taken of observations

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[2] TRS compounds analyzed will be dimethyl disulfide, dimethyl sulfide, hydrogen sulfide, and methyl mercaptan.
[3] Modified to use a S-type pitot because it is expected that a p-type pitot may plug due to the presence of sawdust and the moisture content of the gas stream.

9. **Horizon Engrg. Contacts:** David Bagwell or
Joe Heffernan
(503) 255-5050
Fax (503) 255-0505
E-mail dbagwell@horizonengineering.com
jheffernan@horizonengineering.com

10. **Source Site Personnel:** Rick Wilkinson
(208) 799-1684
E-mail Rick.Wilkinson@clearwaterpaper.com

Marv Lewallen
Office (509)-344-5956
Mobile (509)-280-5266
E-mail marv.lewallen@clearwaterpaper.com

Bob Pernsteiner
(509) 254-7571
bobpern@gmail.com

11. **Regulatory Contacts:** Zach Hedgpeth, P.E.
(206) 553-1217
E-mail hedgpeth.zach@epa.gov

Roylene Cunningham
(206) 553-0513
E-mail cunningham.roylene@epa.gov

12. **Plant Entry & Safety Requirements:** The Horizon team will follow internal safety policies and abide by any site specific safety and entry requirements.

13. **Responsibilities of Horizon Personnel:** The Horizon team will consist of one Project Manager and two Technicians.

14. **Tentative Study Schedule:**

Day 1: Mobilize
Day 2: Begin evaluation
Day 3: Continue evaluation
Day 4: Complete evaluation and demobilize

15. **Other Considerations:** None

16. **Administrative Notes:**

A findings report will be prepared within 30 days after the field work is completed. Per EPA request we plan to include the following information:

- A recommendation regarding the technical feasibility of testing for each of the eight proposed sampling locations.
- Descriptions of all mitigative measures proposed to facilitate the testing.
- Any proposed modification to EPA reference test methods.
- All testing and process data collected during the pre-test feasibility evaluation.
- Analysis and description explaining how the data collected supports the testing feasibility recommendation for each sampling point.

CLW will send one (1) hardcopy of the completed feasibility report to you at the address above.

Any questions or comments relating to this feasibility plan should be directed to me.

Sincerely,

David Bagwell, QSTI
Managing Member
Horizon Engineering, LLC

cc: Rick Wilkinson, Clearwater Paper Corporation
Marv Lewallen, Clearwater Paper Corporation
Bob Pernsteiner, Clearwater Paper Corporation

Kate Krisor

From: Hedgpeth, Zach <Hedgpeth.Zach@epa.gov>
Sent: Wednesday, December 11, 2013 9:44 AM
To: Kate Krisor
Cc: Rick Wilkinson; 'David Bagwell'; Cunningham, Roylene; Vergeront, Julie
Subject: RE: Feasibilty test at Clearwater Paper Dec. 2-5, 2013

Kate,

Thanks for the email. Region 10 grants your request, and will look for the report to be submitted by February 3, 2014.

Thanks,

Zach Hedgpeth, PE
206-553-1217

From: Kate Krisor [mailto:kkrisor@horizonengineering.com]
Sent: Tuesday, December 10, 2013 3:35 PM
To: Hedgpeth, Zach
Cc: Rick Wilkinson; 'David Bagwell'
Subject: RE: Feasibilty test at Clearwater Paper Dec. 2-5, 2013

Zach,
I will be writing Horizon's report for the pre-testing feasibility study at Clearwater Paper in Lewiston Idaho during the week of December 2-5, 2013. We would like to request a 30-day extension for submitting the report to EPA because of the holiday season and the complicated reporting.

The 30-day report deadline as stated in the test plan falls on January 4, 2014, and that time period includes two holidays. We can expect delays in the laboratory report and would also have less Horizon personnel available for report review because of holiday season time-off. In addition, this report is not a standard type of test report and we expect to spend more time than usual in compiling information, consulting with test personnel, and the final QA.

Thank you for considering our request.
Kate Krisor

Kate Krisor
Senior Technical Report Officer
Horizon Engineering, LLC
AmTest Air Quality an affiliate of Horizon Engineering, LLC
503-255-5050 Portland, OR office
425-222-7746 Auburn, WA office
www.horizonengineering.com
www.amtestairquality.com

Quality Assurance Documentation

STAC Interim Accreditation Letter
Horizon Engineering QSTI/QI Certification Dates
Qualified Individual (QI) Certificates
QI Statement of Conformance

500 W. Wood St., Palatine, IL 60067

10 September 2012

Mr. David Bagwell
Horizon Engineering LLC/AmTest
13585 NE Whitaker Way
Portland, OR 97230

VIA E-mail to David Bagwell (dbagwell@horizonengineering.com) with copy to Troy Burrows (TBurrows@entecservices.com)

Dear Mr. Bagwell:

On behalf of the STAC Board of Directors, I am pleased to inform you that Horizon Engineering LLC/AmTest has been granted interim accreditation by the Stack Testing Accreditation Council (STAC), effective 20 August 2012.

After careful review of your Quality System documentation and procedures, STAC has determined that they are in conformance with ASTM D7036-04 “Standard Practice for the competency of Air Emission Testing Bodies.” Final accreditation is contingent upon successful completion of a functional assessment.

During this period of interim accreditation, Horizon Engineering LLC/AmTest may not claim to be a STAC accredited organization, although you may refer to your interim status. To achieve full or final accreditation requires evidence that your Quality System is effectively implemented in your organization as determined by the functional assessment. You may claim that your Quality System meets ASTM D7036 requirements.

Please note that the Attestation of Compliance you signed as part of your application for accreditation requires Horizon Engineering LLC/AmTest to be in continuous compliance with the provisions of ASTM D7036. You are also required to comply with all relevant STAC policies and procedures. I encourage you to review this information, which is available at http://www.betterdata.org/.

If you have any questions, please feel free to contact me at 919.967.0500. Thank you for your participation in the STAC process and congratulations.

Sincerely,
STAC

David L. Elam, Jr.
General Manager

QSTI Employee 19 December 2013	Cert. No.	Group 1 Expirations		Group 2 Expirations		Group 3 Expirations	
		Certificate	Exam (QI)	Certifcate	Exam (QI)	Certificate	Exam (QI)
Andy Vella	2008-247	4 August 2019	24 June 2017	4 August 2019	24 June 2017	4 August 2019	25 June 2017
Angela Hansen	2004-011	-	20 March 2016	-	20 March 2016	20 November 2011	7 March 2011
Carl Slimp	2009-362	3 March 2015	22 May 2018	3 March 2015	26 March 2018	31 July 2018	31 July 2018
C. David Bagwell	2005-022	29 August 2015	22 August 2015	7 June 2016	19 December 2015	29 August 2015	7 March 2015
Jason Bouwman	2009-341	3 June 2014	9 March 2014	3 June 2014	9 March 2014	14 April 2015	7 March 2015
Jason French	2013-771	19 March 2018	05 August 2017	19 March 2018	11 December 2017	19 March 2018	06 August 2017
Joe Heffernan III	2009-325	19 September 2016	16 February 2016	19 September 2016	16 February 2016	23 March 2019	25 March 2018
John Lewis	2011-550	24 August 2016	22 August 2015	24 August 2016	22 August 2015	-	-
Jeanni Kinden	2013-???	-	-	-	-	-	8 September 2018
Kyle Kline	2010-452	23 August 2016	19 December 2015	24 August 2016	7 March 2015	-	-
Preston Skaggs	2011-536	5 July 2016	19 December 2015	5 July 2016	19 December 2015	5 July 2016	22 August 2015
Tom Lyons	2012-721	30 July 2017	24 June 2017	30 July 2017	24 June 2017	30 July 2017	25 June 2017
Thomas Rhodes	2010-408	22 February 2016	29 December 2015	22 February 2016	29 December 2015	14 April 2020	25 March 2018

QSTI Employee 19 December 2013	Cert. No.	Group 4 Expirations		Group 5 Expirations	
		Certificate	Exam (QI)	Certificate	Exam (QI)
Andy Vella	2008-247	23 August 2016	04 August 2015	-	-
Angela Hansen	2004-011	-	-	-	-
Carl Slimp	2009-362	3 March 2015	04 February 2014	-	-
C. David Bagwell	2005-022	-	11 December 2017	-	-
Jason Bouwman	2009-341	3 June 2014	10 March 2014	19 March 2017	04 March 2017
Jason French	2013-771	19 March 2018	11 December 2017	-	-
Joe Heffernan III	2009-325	19 September 2016	17 February 2016	-	-
John Lewis	2011-550	24 August 2016	19 December 2015	-	-
Jeanni Kinden	2013-???	-	-	-	-
Kyle Kline	2010-452	23 August 2016	19 December 2015	-	-
Preston Skaggs	2011-536	8 January 2018	24 June 2017	-	-
Tom Lyons	2012-721	30 July 2017	25 June 2017	-	-
Thomas Rhodes	2010-408	22 February 2016	22 August 2015	-	-

****Red type indicates expired certification or QI as of date above****

Orange type indicates certification/QI within 6 months of expiration from date above

****Green type indicates certification/QI valid for greater than 6 months from date above****

HORIZON ENGINEERING LLC

13585 N.E. Whitaker Way • Portland, OR 97230
Phone (503)255-5050 • Fax (503)255-0505
www.horizonengineering.com

App. #
2009-325

Source Evaluation Society
P. O. Box 12124
Research Triangle Park, NC 27709-2124

JOSEPH M. HEFFERNAN III

Qualified Source Testing Individual

MANUAL GAS VOLUME MEASUREMENTS AND ISOKINETIC PARTICULATE SAMPLING METHODS - **Effective Sept. 20, 2011 through Sept. 19, 2016** *(exam date: 12/30/10)*

MANUAL GAS SOURCE SAMPLING METHODS
- **Effective Sept. 20, 2011 through Sept. 19, 2016** *(exam date: 3/21/11)*

GASEOUS POLLUTANTS INSTRUMENTAL SAMPLING METHODS
- **Effective Mar. 24, 2014 through Mar. 23, 2019** *(exam date: 3/26/13)*

HAZARDOUS METALS MEASUREMENT SAMPLING METHODS
- **Effective Sept. 20, 2011 through Sept. 19, 2016** *(exam date: 12/30/10)*

Name: Joe Heffernan IV Exam Date: 12/16/13

General Low Flow Sampling Techniques
Qualified Individual Examination

This exam covers low flow sampling, recovery and storage techniques for various methods (e.g. EPA 18, EPA 308)

LowFlow_QI_v1.0_Oct2012

By

Jason Bouwman, QSTI

On

29 October 2012

Approved: C. David Bagwell, Managing Member Date: 29 October 2012

Approved: Jason Bouwman, Quality Manager Date: 29 October 2012

<u>You have one (1) hour to complete this open book exam.</u>

A passing score is 15 correct out of 20 (75%) questions. This qualification is valid three (3) years from the date the exam is taken and passed.

Score: 15 **Passes: Yes / No**

SOURCE EVALUATION SOCIETY

SES

Qualified Source Testing Individual

LET IT BE KNOWN THAT

JOSEPH M. HEFFERNAN III

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

MANUAL GAS VOLUME MEASUREMENTS AND ISOKINETIC PARTICULATE SAMPLING METHODS

ISSUED THIS 20TH DAY OF SEPTEMBER 2011 AND EFFECTIVE UNTIL SEPTEMBER 19TH , 2016

Peter R. Westlin, QSTI/QSTO Review Board

Peter S. Pakalnis, QSTI/QSTO Review Board

LeRoy Owens, QSTI/QSTO Review Board

C. David Bagwell, QSTI/QSTO Review Board

Karen D. Kajiya-Mills , QSTI/QSTO Review Board

Glenn C. England, QSTI/QSTO Review Board

APPLICATION NO. 2009-325

SOURCE EVALUATION SOCIETY CORPORATE SEAL 1995 NORTH CAROLINA

SOURCE EVALUATION SOCIETY

Qualified Source Testing Individual

LET IT BE KNOWN THAT

JOSEPH M. HEFFERNAN III

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

MANUAL GASEOUS POLLUTANTS SOURCE SAMPLING METHODS

ISSUED THIS 20TH DAY OF SEPTEMBER 2011 AND EFFECTIVE UNTIL SEPTEMBER 19TH , 2016

Peter R. Westlin, QSTI/QSTO Review Board

Peter S. Pakalnis, QSTI/QSTO Review Board

LeRoy Owens, QSTI/QSTO Review Board

C. David Bagwell, QSTI/QSTO Review Board

Karen D. Kajiya-Mills , QSTI/QSTO Review Board

Glenn C. England, QSTI/QSTO Review Board

APPLICATION NO. 2009-325

App. #
2012-721

Source Evaluation Society
P. O. Box 12124
Research Triangle Park, NC 27709-2124

THOMAS A. LYONS

Qualified Source Testing Individual

MANUAL GAS VOLUME MEASUREMENTS AND ISOKINETIC PARTICULATE SAMPLING METHODS - **Effective Jul. 31, 2012 through Jul. 30, 2017** *(exam date: 6/25/12)*

MANUAL GAS SOURCE SAMPLING METHODS
- **Effective Jul. 31, 2012 through Jul. 30, 2017** *(exam date: 6/25/12)*

GASEOUS POLLUTANTS INSTRUMENTAL SAMPLING METHODS
- **Effective Jul. 31, 2012 through Jul. 30, 2017** *(exam date: 6/26/12)*

HAZARDOUS METALS MEASUREMENT SAMPLING METHODS
- **Effective Jul. 31, 2012 through Jul. 30, 2017** *(exam date: 6/26/12)*

SOURCE EVALUATION SOCIETY

Qualified Source Testing Individual

LET IT BE KNOWN THAT

THOMAS A. LYONS

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

MANUAL GAS VOLUME MEASUREMENTS AND ISOKINETIC PARTICULATE SAMPLING METHODS

ISSUED THIS 31st DAY OF JULY 2012 AND EFFECTIVE UNTIL JULY 30TH, 2017

Peter R. Westlin, QSTI/QSTO Review Board

Peter S. Pakalnis, QSTI/QSTO Review Board

LeRoy Owens, QSTI/QSTO Review Board

C. David Bagwell, QSTI/QSTO Review Board

Karen D. Kajiya-Mills, QSTI/QSTO Review Board

Glenn C. England, QSTI/QSTO Review Board

APPLICATION NO. 2012-721

SOURCE EVALUATION SOCIETY

Qualified Source Testing Individual

LET IT BE KNOWN THAT

THOMAS A. LYONS

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

MANUAL GASEOUS POLLUTANTS SOURCE SAMPLING METHODS

ISSUED THIS 31st DAY OF JULY 2012 AND EFFECTIVE UNTIL JULY 30TH, 2017

Peter R. Westlin, QSTI/QSTO Review Board

Peter S. Pakalnis, QSTI/QSTO Review Board

LeRoy Owens, QSTI/QSTO Review Board

C. David Bagwell, QSTI/QSTO Review Board

Karen D. Kajiya-Mills

Karen D. Kajiya-Mills , QSTI/QSTO Review Board

Glenn C. England, QSTI/QSTO Review Board

APPLICATION NO. 2012-721

SOURCE EVALUATION SOCIETY CORPORATE SEAL 1995 NORTH CAROLINA

SOURCE EVALUATION SOCIETY

Qualified Source Testing Individual

LET IT BE KNOWN THAT

KYLE R. KLINE

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

MANUAL GAS VOLUME MEASUREMENTS AND ISOKINETIC PARTICULATE SAMPLING METHODS

ISSUED THIS 24TH DAY OF AUGUST 2011 AND EFFECTIVE UNTIL AUGUST 23RD , 2016

Peter R. Westlin, QSTI/QSTO Review Board

C. David Bagwell, QSTI/QSTO Review Board

Karen D. Kajiya-Mills

Karen D. Kajiya-Mills , QSTI/QSTO Review Board

Peter S. Pakalnis, QSTI/QSTO Review Board

LeRoy Owens, QSTI/QSTO Review Board

Glenn C. England, QSTI/QSTO Review Board

APPLICATION NO. 2010-452

HORIZON ENGINEERING 13-4980

SOURCE EVALUATION SOCIETY

Qualified Source Testing Individual

LET IT BE KNOWN THAT

KYLE R. KLINE

HAS SUCCESSFULLY PASSED A COMPREHENSIVE EXAMINATION AND SATISFIED EXPERIENCE REQUIREMENTS IN ACCORDANCE WITH THE GUIDELINES ISSUED BY THE SES QUALIFIED SOURCE TEST INDIVIDUAL REVIEW BOARD FOR

MANUAL GASEOUS POLLUTANTS SOURCE SAMPLING METHODS

ISSUED THIS 25TH DAY OF AUGUST 2010 AND EFFECTIVE UNTIL AUGUST 24TH, 2015

Peter R. Westlin, QSTI/QSTO Review Board

Peter S. Pakalnis, QSTI/QSTO Review Board

LeRoy Owens, QSTI/QSTO Review Board

C. David Bagwell, QSTI/QSTO Review Board

Karen D. Kajiya-Mills, QSTI/QSTO Review Board

Glenn C. England, QSTI/QSTO Review Board

APPLICATION NO. 2010-452

Name: Kyle Kline Exam Date: 10/29/12

General Low Flow Sampling Techniques
Qualified Individual Examination

This exam covers low flow sampling, recovery and storage techniques for various methods (e.g. EPA 18, EPA 308)

LowFlow_QI_v1.0_Oct2012

By

Jason Bouwman, QSTI

On

29 October 2012

Approved: C. David Bagwell, Managing Member Date: 29 October 2012

Approved: Jason Bouwman, Quality Manager Date: 29 October 2012

You have one (1) hour to complete this open book exam.

A passing score is 15 correct out of 20 (75%) questions. This qualification is valid three (3) years from the date the exam is taken and passed.

Score: 17 1/2 **Passes: Yes / No**

HORIZON ENGINEERING LLC

13585 NE Whitaker Way • Portland, OR 97230
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www.horizonengineering.com

Qualified Individual Statement of Conformance

I, as a qualified individual, agree that all projects of which I participate will conform to the policies set forth in Horizon Engineering, LLC's quality manual and to the standards outlined in ASTM D7036 in all respects.

Signature: ____________________

Name (print): Jae Heffernan III

Date: 8/16/12

HORIZON ENGINEERING LLC

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www.horizonengineering.com

Qualified Individual Statement of Conformance

I, as a qualified individual, agree that all projects for which I participate will conform to the policies set forth in Horizon Engineering, LLC's quality assurance manual and to the standards outlined in ASTM D7036 in all respects.

Signature: Kyle Kline

Name (print): Kyle Kline

Date: 9/24/12

HORIZON ENGINEERING LLC

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www.horizonengineering.com

Qualified Individual Statement of Conformance

I, as a qualified individual, agree that all projects for which I participate will conform to the policies set forth in Horizon Engineering, LLC's quality assurance manual and to the standards outlined in ASTM D7036 in all respects.

Signature: ______________________

Name (print): Thomas Lyons

Date: 9-24-12

Personnel Qualifications

JOSEPH M. HEFFERNAN III, QSTI (GI-IV)
PROJECT MANAGER/TEAM LEADER

EDUCATION/PROFESSIONAL CERTIFICATIONS/TRAINING

- Qualified Source Test Individual (QSTI)
  - Group I, *Manual Gas Volume and Flow Measurements and Isokinetic Particulate Sampling Methods*
  - Group II, Manual Gas Source Sampling Methods
  - Group III, Gaseous Pollutants Instrumental Methods
  - Group IV, *Hazardous Metals Measurements*
- B.S. in Physical Education from Northern Illinois University, 1999
- Minor in Marketing, with emphasis in Sports Marketing
- Certified Visible Emissions Evaluator
- C-Stop Certified (includes refinery operations, industrial accident prevention, PPE, LOTO, HAZCOM/HAZMAT, confined space, emergency response, respiratory protection, MSDS review, toxic and hazardous substances)
- Aerial Platform Certified
- Transportation Worker Identification Credential (TWIC) Approved
- International Air Transport Association (IATA) Trained
- Respirator Fit-Tested
- Adult CPR Certified
- Standard First Aid Certified

PROFESSIONAL DEVELOPMENT

- Stationary Source Sampling and Analysis for Air Pollutants (SSSAAP) Conference, 2008, 2011

PROFESSIONAL MEMBERSHIPS

- Source Evaluation Society (SES)

PROFESSIONAL EXPERIENCE

Joe Heffernan has been with Horizon Engineering since 2004. He brings four prior years experience from another air pollution testing organization in Illinois for a total of more than 12 years of professional experience in the field of air quality. He has performed source tests at hundreds of industrial sources domestically and internationally and has developed the skills necessary to earn the title of Project Manager. He performs source emission testing and activities related to source emission testing, including field sampling, test equipment maintenance and calibration, equipment preparation, and in-field data recording. He is thoroughly trained in all EPA source test procedures 2000-present. He is also experienced using methods from the National Council for Air & Stream Improvement (NCASI), Oregon Department of Environmental Quality (ODEQ), California Air Resource Board (CARB), National Institute for Occupational Health and Safety (NIOSH), Occupational Safety and Health Administration (OSHA), and the American Society for Testing and Materials (ASTM).

THOMAS A. LYONS
FIELD TECHNICIAN III

EDUCATION/PROFESSIONAL CERTIFICATIONS/TRAINING

- Qualified Source Test Individual (QSTI)
  - Group I, *Manual Gas Volume and Flow Measurements and Isokinetic Particulate Sampling Methods*
  - Group II, Manual *Gaseous Pollutants Source Sampling Methods*
  - Group III, *Gaseous Pollutants Instrumental Methods*
  - Group IV, *Hazardous Metals Measurements*
- B.S. in Biology from University of Oregon, 2008
- Minor in Biochemistry and Computer Information Technology
- Studied abroad at University of Otago, New Zealand, 2005
- Certified Visible Emissions Evaluator
- C-Stop Certified (includes refinery operations, industrial accident prevention, PPE, LOTO, HAZCOM/HAZMAT, confined space, emergency response, respiratory protection, MSDS review, toxic and hazardous substances)
- Aerial Platform Certified
- Transportation Worker Identification Credential (TWIC) Approved
- International Air Transport Association (IATA) Trained
- Respirator Fit-Tested
- Adult CPR Certified
- Standard First Aid Certified
- Wilderness First Responder (WFR) and Emergency Medical Training (EMT), 2010

PROFESSIONAL MEMBERSHIPS

- Source Evaluation Society (SES)

PROFESSIONAL EXPERIENCE

Thomas Lyons joined Horizon Engineering in 2011. He brings three prior years of laboratory experience as a cell biologist and a quality control technician. He performs source emission testing and activities related to source emission testing, including field sampling, test equipment maintenance and calibration, equipment preparation, and in-field data recording.

KYLE R. KLINE, QSTI (GI, II, IV)
FIELD TECHNICIAN III

EDUCATION/PROFESSIONAL CERTIFICATIONS/TRAINING

- Qualified Source Test Individual (QSTI)
  - Group I, *Manual Gas Volume and Flow Measurements and Isokinetic Particulate Sampling Methods*
  - Group II, *Manual Gaseous Pollutants Source Sampling Methods*
  - Group IV, *Hazardous Metals Measurements*
- B.S. in Environmental Studies from Southern Oregon University, 1999
- Certified Visible Emissions Evaluator
- C-Stop Certified (includes refinery operations, industrial accident prevention, PPE, LOTO, HAZCOM/HAZMAT, confined space, emergency response, respiratory protection, MSDS review, toxic and hazardous substances)
- North Slope Training Co-operative class for Unescorted North Slope Safety Orientation (Awareness Level)
- Aerial Platform Certified
- Transportation Worker Identification Credential (TWIC) Approved
- International Air Transport Association (IATA) Trained
- Respirator Fit-Tested
- Adult CPR Certified
- Standard First Aid Certified

PROFESSIONAL DEVELOPMENT

- Stationary Source Sampling and Analysis for Air Pollutants (SSSAAP) Conference, 2010

PROFESSIONAL MEMBERSHIPS

- Source Evaluation Society (SES)

PROFESSIONAL EXPERIENCE

Kyle Kline has been with Horizon Engineering since 2004. He brings four seasons of prior experience working as an Air Quality Field Technician in Yosemite National Park. He has performed source tests at hundreds of industrial sources. He performs source emission testing and activities related to source emission testing, including field sampling, test equipment maintenance and calibration, equipment preparation, and in-field data recording. He is thoroughly trained in all EPA source test procedures 2004-present. He is also experienced using methods from the National Council for Air & Stream Improvement (NCASI), Oregon Department of Environmental Quality (ODEQ), California Air Resource Board (CARB), National Institute for Occupational Health and Safety (NIOSH), Occupational Safety and Health Administration (OSHA), and the American Society for Testing and Materials (ASTM).

JASON SWEENEY
FIELD TECHNICIAN I

EDUCATION/PROFESSIONAL CERTIFICATIONS/TRAINING

- B.S. in Environmental Science, University of Idaho, Moscow, Idaho, 2005
- Certified Visible Emissions Evaluator
- C-Stop Certified (includes refinery operations, industrial accident prevention, PPE, LOTO, HAZCOM/HAZMAT, confined space, emergency response, respiratory protection, MSDS review, toxic and hazardous substances)
- Certified Oregon Boater, State Marine Board
- Certified Marbled Murrelet Surveyor
- Aerial Platform Certified
- Transportation Worker Identification Credential (TWIC) Approved
- International Air Transport Association (IATA) Trained
- Respirator Fit-Tested
- Certified First Responder
- Red Cross CPR Certified
- Red Cross First Aid Certified

PROFESSIONAL EXPERIENCE

Jason Sweeney has been with Horizon Engineering since October 2013. He brings six prior years experience working for Environ International Corporation. His primary duties before joining Horizon were ambient air quality monitoring, soil monitoring, and water quality monitoring. He also assisted in developing a web-based information management system for litigation support and performed contaminated site assessments. He also worked previously as an air quality technician with the Idaho Department of Environmental Quality and as a forest technician and fireman with the Idaho Department of Lands.

With Horizon, he performs source emission testing and activities related to source emission testing, including field sampling, test equipment maintenance and calibration, equipment preparation, and in-field data recording. He is being trained to perform source emission testing and activities related to testing, field sampling, test equipment maintenance and calibration, equipment preparation, and in-field data recording. He is familiar with all EPA source test procedures and is also learning methods from the National Council for Air & Stream Improvement (NCASI), Oregon Department of Environmental Quality (ODEQ), California Air Resource Board (CARB), National Institute for Occupational Health and Safety (NIOSH), Occupational Safety and Health Administration (OSHA), and the American Society for Testing and Materials (ASTM).

DAVID BAGWELL, QSTI (GI-III)
MANAGING MEMBER/TECHNICAL MANAGER

EDUCATION/PROFESSIONAL CERTIFICATIONS/TRAINING

- Qualified Source Test Individual (QSTI)
  - Group I, *Manual Gas Volume and Flow Measurements and Isokinetic Particulate Sampling Methods*
  - Group II, *Manual Gaseous Pollutants Source Sampling Methods*
  - Group III, *Gaseous Pollutants Instrumental Methods*
  - Group IV, *Hazardous Metals Measurements* (passed exam, application pending)
- B.S. in Industrial Management from the Georgia Institute of Technology, 1993
- Certified Visible Emissions Evaluator
- C-Stop Certified (includes refinery operations, industrial accident prevention, PPE, LOTO, HAZCOM/HAZMAT, confined space, emergency response, respiratory protection, MSDS review, toxic and hazardous substances)
- Aerial Platform Certified
- Transportation Worker Identification Credential (TWIC) Approved
- International Air Transport Association (IATA) Trained
- Adult CPR Certified
- Standard First Aid Certified

PROFESSIONAL DEVELOPMENT

- Fundamentals of Source Sampling, instructed by Mr. Bill Timpone, 1994
- Fundamentals of Enforcement, California Air Resources Board, 2007
- Stationary Source Sampling and Analysis for Air Pollutants (SSSAAP) Conference, attended since approximately year 2000

PROFESSIONAL MEMBERSHIPS

- Air and Waste Management Association (A&WMA)
- Pacific Northwest International Section of A&WMA (PNWIS)
- Source Evaluation Society (SES)
- ASTM International Committee D22 on Air Quality

AWARDS RECEIVED

- PNWIS/A&WMA Hardhat Award, 2007
- SES Matthew S. DeVito Award, 2011

CURRENT LEADERSHIP POSITIONS

- Source Evaluation Society QSTI/QSTO Review Panel
- Source Evaluation Society Board of Directors Member
- PNWIS, Oregon Chapter Board of Directors Member

PROFESSIONAL EXPERIENCE

David Bagwell has been with Horizon Engineering since 1997 and acquired the company in 2008. He brings three prior years experience from other air pollution testing organizations in Georgia and Oregon for a total of more than 17 years of professional experience in the field of air quality. He has tested over a thousand sources domestically and internationally and now owns and manages a successful multi-office source testing firm with over 20 employees. He is thoroughly trained in all EPA source test procedures 1994-present. He is also experienced using methods from the National Council for Air & Stream Improvement (NCASI), Oregon Department of Environmental Quality (ODEQ), California Air Resource Board (CARB), National Institute for Occupational Health and Safety (NIOSH), Occupational Safety and Health Administration (OSHA), and the American Society for Testing and Materials (ASTM). At the SES conference in 2011, David received the Matthew S. DeVito award for his dedication to data quality, commitment to staff education and safe field and laboratory practices, and his support of the SES QSTI/QSTO program,

MICHAEL E. WALLACE, P.E.
SENIOR ENGINEER

EDUCATION/PROFESSIONAL CERTIFICATIONS/TRAINING

- Professional Engineer (P.E.) from the State of Oregon, 2002-present
- B.S. in Mechanical Engineering from Oregon State University in Corvallis, Oregon, 1989
- Respirator Fit-Tested
- Adult CPR Certified
- Standard First Aid Certified

PROFESSIONAL DEVELOPMENT

- Stationary Source Sampling and Analysis for Air Pollutants (SSSAAP) Conference, approximately 5 years

PROFESSIONAL MEMBERSHIPS

- Source Evaluation Society (SES)

PROFESSIONAL EXPERIENCE

Mike Wallace has been with Horizon Engineering since 1991. He is responsible for performing calculations, formulating spreadsheets, quality assurance review, and operating Horizon's gas chromatograph. He is thoroughly trained in all EPA source test procedures 1991-present. He is also experienced using methods from the National Council for Air & Stream Improvement (NCASI), Oregon Department of Environmental Quality (ODEQ), California Air Resource Board (CARB), National Institute for Occupational Health and Safety (NIOSH), Occupational Safety and Health Administration (OSHA), and the American Society for Testing and Materials (ASTM).

PATRICIA LYNN (KATE) KRISOR
SENIOR TECHNICAL REPORT WRITER/SAFETY MANAGER

EDUCATION/PROFESSIONAL CERTIFICATIONS/TRAINING

- B.A. in General Science from Portland State University in Portland, Oregon, 1995
- Minor in Technical Writing
- International Air Transport Association (IATA) Trained
- Adult CPR Certified
- Standard First Aid Certified

PROFESSIONAL DEVELOPMENT

- EPA Webinars on Boiler and Process Heater Emission Testing for Boiler/CISCWI ICR, June 18, 2009 and September 18, 2009

PROFESSIONAL MEMBERSHIPS

- Source Evaluation Society (SES)

PROFESSIONAL EXPERIENCE

Kate Krisor has been with Horizon Engineering since 1995. Her current responsibilities include data reduction and analysis, quality assurance review, and report preparation. She is also the Safety Manager for Horizon and tracks our cylinder gas inventory. She is thoroughly trained in all EPA source test procedures 1995-present. She is also experienced researching/reporting methods from the National Council for Air & Stream Improvement (NCASI), Oregon Department of Environmental Quality (ODEQ), California Air Resource Board (CARB), National Institute for Occupational Health and Safety (NIOSH), Occupational Safety and Health Administration (OSHA), and the American Society for Testing and Materials (ASTM).

This is The Last Page of the Report